

II Not About Sex — Vernacular Dance, Attention, Affect, and Self-Organization

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Abstract: *Cognitive scientists and lay-people frequently buy into the trope that vernacular dance is primarily an evolutionary mechanism for sexual selection. I argue against the dance-as-sexual-selection hypothesis; the structure of attention, affect, and agency in dance are all geared towards experiences of the collective, not the identification of single individuals. I call into question several problematic assumptions about dance in the sexual selection literature and point to flawed experimental designs. Using dynamic systems, phenomenological evidence, and embodied cognition, I argue that vernacular dance is, first and foremost, tied to a deep-felt sense of connection and embodied equilibrium with others and with the environment. Connection through dance is tied to some of our most fundamental bio-cognitive processes involved in the body's ongoing autopoietic self-organization.*

Keywords:

1. Introduction

Despite solid contrary evidence, many researchers (especially in evolutionary psychology) still operate with the underlying principle that underneath its other functions, dance is primarily about sexual selection. The myth that dancing is primarily about sex is also alive and well amongst many non-dance-practicing lay people. This article provides another argument for why dance is not primarily about sexual selection. Much dance can implement erotic elements, and sometimes dance can, in fact, be about sexual selection; this, however, is by no means the primary social, cultural, evolutionary, or psychological function of dance. As I will show, dance is first and foremost tied to a deep-felt sense of connection and embodied equilibrium with each other and with the environment. Connection through dance is tied to some of our most fundamental bio-cognitive processes involved in the body's ongoing autopoietic self-organization.

Before moving into the argument, I want to address its scope. I am here only talking about vernacular dance; dances that are developed organically by cultures for the participants by the participants (which does include vernacular dances performed on a stage). I am not making any claims about dancing and sexuality or expressions of sexuality. I am a cognitive scientist, not a paleontologist, and will therefore not be making any claims about the actual timeline of proto-

dance or dance in hominin evolution. I am making a claim about many of the cognitive sciences, not the humanities (although I suspect the dance-sex myth might also be alive there. But that would be a different article). It is important to note that I am not making a puritanical argument. I am not claiming that dance is never about sex, sexuality, or eroticism. Neither am I claiming that it is somehow morally questionable when dance is about sex. Dance can often be a liberating medium to sexually express, understand, and encounter oneself and others. Furthermore, much of the research on dance and sex is very good and illuminating. What I am saying, however, is that it is a misunderstanding to think that the primary function of dance is related to sex.

2. The Myth of Vernacular Dance and Sexual Selection

Charles Darwin famously ties dancing across species to a display of prowess for sexual selection; the idea that dance is tied to sexual selection is as old as the theory of evolution itself (Darwin, 1872). Across the dance-as-sexual-selection literature, the underlying argument is that dance is a mechanism by which an animal signals how it stands out from the rest of the group. Dancing, supposedly, highlights the traits possessed by the individual animal that are relevant to survival and reproduction. Put in layman's terms; “look at me, I am strong, I am fast, I am coordinated, I can fight, I am so awesome I don’t have to worry about frivolously spending a lot of calories on two-stepping, look how much I stand out from these other dudes, pick me you won’t regret it, pick me, pick me, pick me.” The general underlying assumption in this literature is that, albeit more complex, human dancing is functionally no different from other mating displays.

The following studies all, with slight variations of the theme, use the sexual selection mechanism in dance to explain their findings. Studies have shown that men dancing together are perceived by women to be more sexually viable because those men display cooperative skills with other males (Metin & Tekozel, 2024). Another study argues that male symmetrical dance moves are more attractive to women, just as male dance moves that display strength are considered better and more attractive to women (Brown et al., 2005; McCarty et al., 2013). Symmetry in movement, supposedly, displays good genes for hunting, gathering, protecting, etc. Similarly, female dance moves are considered more attractive and better when displaying large hip swings and asymmetry — wide hips and swinging supposedly indicate the ability to carry and successfully birth offspring (McCarty et al., 2017). In another dance movement ranking observation study, it is argued that variation in dance movement is an indicator of higher sexual fitness (Hugill et al., 2010). In this same vein, it is argued that male participants spend more time attending to attractive female dancers because dance is a mechanism for identifying sexually relevant features, for example, by showing the flexibility and width of one’s hips (Röder et al., 2016). Following the logic of “women’s-taste-in-dance-moves-reflect-their-sexual-selection-criteria” a recent review article hypothesizes;

Elaborate dance movements are challenging actions that require a high level of coordination, and only individuals with the relevant physical and neural skills can perform them. Because “good” dancing is not only artistic and appealing but also energetically demanding, we hypothesize that women will rate dances of men in better physical condition to be more attractive than dances of men in poorer physical condition (Fink et al., 2021).

Again, we see the sexual selection logic at play. It is assumed that women will be unable to look at the aesthetic features of dance moves and instead subconsciously judge such movements

simply based on the reproductively relevant physical features of the dancer. Similarly, it is argued that male risk-taking behavior is considered evolutionarily relevant to sexual selection and, therefore, attractive (the why-we-like-bad-boys thesis). In dance, risk-taking behavior in male dancers is considered by women onlookers to be more attractive (Hugill et al., 2011). As we can see from this brief review, the idea that dance can functionally be reduced to sexual selection is alive and well in various corners of cognitive psychology and other cognitive sciences.

The Cultural Myth of Dance and Sex

Next, we will briefly examine North American and European pop-cultural attitudes towards dance and sex. One reason that the “dance is for sex” myth is still alive in the cognitive sciences could be that the myth is strongly embedded into much Western culture, and the starting point for any academic is (whether they will admit it or not) their cultural context. To fully cover the cultural history of the “dance is inherently sexual” myth would be a monograph-sized undertaking, but see (Ehrenreich, 2007) for a good start on the European and North American portion. In this article, I will only briefly mention a few prominent cultural themes in which we see the myth at work. This strategy is simply to further convince the reader that the dance-sex linkage is still very much alive both across academia and popular culture at least in North America and much of Europe.

Let us begin in the vernacular. There is still a pervasive cultural attitude in North America and much of Europe that, *vernacular dance* (especially from dance forms associated with people of color) is primarily about sex. For example, “twerking,” despite being a celebratory dance, is within popular culture most commonly associated with the hyper-sexualization of women’s bodies, and an indication that the woman in question is willing, able, and good at heterosexual intercourse (Gaunt, 2015; Kitata, 2020). This form of expression is typically scolded, yet desired, when performed by black and brown bodies, but celebrated when performed by white bodies (Halliday, 2020). Dance movies (especially those about vernacular dance) are often tied to sexualization and sexual selection, especially of non-white bodies (Borelli & Monroe, 2014). However, as demonstrated by *Black Swan* (2010) and *Tiny Pretty Things* (2020), movies and TV shows about ballet also participate in the ongoing history of connecting dance to sex. Especially Black and Latin dances have been tied to sex and sexual selection through screen-based media (Lundy, 2018; Mpofu, 2022; Ovalle, 2011). Here, we need only think back to the *Step-Up* series (2006–2014), *Honey* (2003), or any of the many other dance movies that dominated North America and Europe in the twenty-tens or the nineteen-eighties to see the emphasis on dancing as a vehicle for sex and sexual selection. The message that dance is a vehicle for sex is only further perpetuated through various social media challenges across Instagram, Tik-Tok, and other platforms (Robinson, 2023).

Multiple globally successful streaming shows (with hundreds of millions of viewers worldwide) that purport to show historical dance also portray dance as primarily a mechanism for mate selection. For example, in Netflix’s international mega-hit series *Bridgerton* (2020–ongoing), aristocratic ballroom dances are shown entirely as a social ritual for ascertaining the viability of a sexual match (through marriage). Aristocratic dance is here reduced to its Darwinian function but in a strictly controlled and genteel fashion. While court dances at various junctures and locations in European history did function as mating marketplaces, these spaces were also highly complex negotiations of power, agency, history, aesthetic tastes, and more (Franko, 2015; Pakes, 2020).

Even within popular culture that claims to be “scientific,” we see the continuation of the idea

that dance is inherently tied to sex and sexual selection. For example, the very first episode of the “science-based” show *100 Humans* (Netflix, 2020) ran an experiment that linked the quality of men’s dance moves to the quality of their sperm. In the episode, audience members were asked to rate the dance moves of a series of men. The highest-ranked dancers were then compared to the health quality of their sperm samples. This, in turn, disproved the show’s “researcher’s” hypothesis that there is a connection between dance movements and the quality of sperm. While the research design is (obviously) invalid, the episode is a good example of the persistent North American and European myth that dance is tied to sexual fitness and sexual selection and that such a view is scientific and, therefore, legitimate.

Similarly, when the video company Masterclass, which claims to offer video courses with “the world’s leading experts,” offered its first dance-related course, it was with Parris Goebel, a choreographer known for the “exotic” style, that focuses almost exclusively on male-gaze-oriented music video dance. Here, the subtext of the marketing is that the “best dancer” is, of course, someone who makes the most sexually arousing dance. Beneath this marketing choice from Masterclass is the old assumption that dance is about sex. So, to be the best at dance, the dancing must look explicitly sexualized. The untrained dance viewer is convinced that the dancing offered in the Masterclass course is amongst the best because it looks overtly “sexy.” It is always important to remember that dance as a human activity, unfortunately, is also subject to capitalist market forces, and the myth of the dance-sex linkage is often perpetuated because of the truth that sex sells.

I am here making a very condensed claim pertaining only to North America and (much of) Europe. A more in-depth study is needed to investigate similar claims about other regions. While I do not have the page space to discuss the various causes and origins of the cultural myth, I hope to have at least indicated that the scientific focus on the dance-sex linkage and the cultural focus on the sex-dance linkage are similar and likely reinforce one another.

3. Against the Sexual Selection Thesis

Next, I will point out problems with the experimental design and the arguments and assumptions made by the empirical literature we surveyed above. An important article by Christensen and colleagues takes on a similar project. Their research team outlines a number of reasons including but not limited to, group cohesion, cultural memory, and entrainment, why dance is not just for sexual selection (Christensen et al., 2017). I continue this line of argumentation, by pointing to the cognitive structure of attention, affect, and agency in dance.

Problems with Experimental Design

First, we must ask about the ecological validity of the various dance-moves-ranking studies surveyed above. Does explicitly asking participants in an artificial laboratory setting to rank people or dance moves tell us anything about actual ecologically embedded cognitive processes? I, for one, am skeptical. For example, a rigorous review of studies claiming to measure automaticity versus top-down control in expert athletic action has been largely shown to be ecologically invalid because the laboratory setting itself skews how athletes think and move (Montero, 2016). Similarly, these ranking activities remove all context from the rich ecology of dances as living breathing cultures with narratives, memory sharing, enculturation, and more (Kronsted, 2021). This, in turn, removes all the intentions an agent has for dancing or looking at dance, putting an artificial focus on ranking that normally does not take place during culturally significant dance practices. Furthermore, ranking activities in a laboratory setting automatically assumes the hypothesis the ranking activity is meant to prove. Such activities assume that dancing is

for the sake of ranking mates and then explicitly ask participants to rank individuals. Dance ranking studies are designed to reinforce the very logic they are meant to prove in the first place.

In addition, these studies typically have not been reproduced and utilize small sample sizes. It is also important to note that this research program aims to make claims about all humans but typically only runs experiments on W.E.I.R.D White people — Western, Educated, Industrialized, Rich, and Democratic (Henrich et al. 2010). The way we look at, appreciate, and evaluate dance differs drastically from culture to culture, meaning that the “ranking” of dancing is also a culturally influenced product. Thus, these studies need much more culturally diverse data to make universal claims about the connections between dance movements and preferences.

Flawed Assumptions and Gaps

Human dance is far too metabolically demanding to be primarily a sexual selection process (Christensen et al., 2017). While evolution does not care for beauty, it does care about efficiency, and there are far more efficient and multifunctional ways to determine if an individual has suitable genes worthy of procreation. Agents who dance must take time and resources to physically recover from dancing, making it further from procreation; a resting partner is not a mating partner. In addition, dance and dance-like activities make its participants more vulnerable to external threats since dancing humans are less aware of their surroundings and spend their time exhausting their resources instead of being productive.

Christensen et al. point out that theories on dance as sexual selection have been completely silent on the fact that children and seniors frequently and spontaneously dance (Christensen et al., 2017, p. 22). Here, I further add that these theories are also silent on why people in committed relationships, queer people, pregnant people, and infertile people all engage in dance with equal enthusiasm. If dance is a mechanism for sexual selection, then we should not see its prevalence amongst those for whom reproductive mate selection is a non-issue.

In extension to this argument, I also point out that the sexual selection literature says nothing about why most people highly enjoy dancing by themselves (and sometimes exclusively dance alone). Again, this is not a phenomenon we should observe if the dance as sexual selection theory is true. The sexual selection literature also does not count for actual dance communities in which many dances are done only with the same sex and gender, or only with other dance enthusiasts.

Furthermore, many of the biological mechanisms for sexual selection the literature highlights in dance are much older than dance and can take place without being in the context of dance. For example, we do learn about genetic compatibility with other people through pheromones in sweat smell. However, any sweat-producing activity will do. Similarly, moving with grace, control, strength, symmetry, and purpose are all features that have been highlighted as driving mate selection in dance. All of these movement qualities take place in dance and in many other human activities that are much older than dance. Such activities are also typically more functional than dance and do have an immediate “productive” purpose. Why dance to show off one’s prowess when we can simply go hunting and show off our hunting skills?

In addition, it is harder to explain why dance should be therapeutic for patients with autism and or schizophrenia if dance is primarily a mate selection mechanism (Hye-jin et al., 2015; Koch et al., 2015; Lilly et al., 2016). Schizophrenia and autism are complex conditions that are often driven by an experience of disrupted embodiment. If dance is for the selection of mates, then attention during dance would be outwards directed and focused mostly on the body of others. Dance movement therapy, however, demonstrates that attention and cognitive resources

during dance are often highly introspective and can focus on many aspects of self-experience not related to sex (Kronsted, 2018; Levine & Land, 2016; Millman et al., 2021; Solveig & Sabine, 2017).

Finally, the literature reviewed in this article ignores dance studies and anthropological, sociological, philosophical, and historical accounts of dance. In other words, these studies do not take seriously the vast literature investigating dance from a social-cultural perspective. Rather, they begin by assuming the underlying truth of what they are trying to prove, namely that cultural concerns about dance reduce to sex.

Continuing to focus on the sexual aspects of dance (whether in scientific research or in popular cultural discourse) can obscure the many functions and benefits of dance that often go underutilized — dance can offer us so much more. Furthermore, we risk misunderstanding many dance and dance-like cultural and cognitive phenomena if we investigate them through the lens of sex. As Christensen and colleagues point out (and I concur) the fact that dance can aid in mate selection is a nice by-product of dance but not the primary function of dance (Christensen et al., 2017).

4. Collective Attention Affect, and Joint Agency in Dance

Next, let us look at attention, affect, and joint agency in dance to further see why the shape of these phenomena during dance puts pressure on the dance-as-sexual-selection-thesis. I argue that dance as an activity is structured in such a way that attention is frequently directed toward the collective and not individuals. This structure of dance as a general activity indicates that the primary function of dance is not sexual selection; rather, dancing is for the creation of group connection.

Attention

Theorizing that dance reduces to individual selective advantages does not fit with the empirical reality of performing most vernacular dances.¹ In short, if dance has really evolved as primarily a mechanism for sexual selection, then attentive and affective processes during dance should be structured to pick out individuals from the crowd. Rather, what we see is that during dance attention and affect oscillate between the body and being directed at the crowd, not individuals (Kronsted, 2021; Ravn, 2020). It is true that some dances have culturally developed to be closely attentive towards one partner at a time: for example, salsa or tango (Kimmel & van Alphen, 2022). However, even in those cases, there is still a general structure of attention and affect that is oriented towards the collective. If tango or salsa dancers do not pay attention to the crowd, they will miss out on what makes the experience culturally significant but also likely crash. Dance is, in its attentional processes, affect, emotion, and movements, frequently directed at a collective, not individuals.

It is important to remember that the sexual selection thesis is based on the assumption that dance demonstrates male dominance. While mating “dances” in birds might be a single male trying to impress a single female, human dancing is typically community-oriented. Dancing in humans is a process that brings attention to a collective and demonstrates multiple agents' abilities to cooperate. This is, for example, evident in dance rituals that lead to collective effervescence, in which dancers become acutely aware of themselves “melting together with the crowd” (Gavanas, 2008; Malbon, 2002; Salkind, 2018; Schöler, 2017; St John, 2004). In these situations, dancing

¹ Such a reduction to individualized processes for the purpose of individualized sexual selection is likely an example of classic “Western” scientific reductionism from a group phenomenon to individuals (Favela & Chemero, 2023; Feiten et al., 2023; Thonhauser & Wetzels, 2020).

leads to acute crowd-oriented attention. Dance as sexual selection theories, however, typically posit that dance is a way for agents to stand out from the group or show dominance. These theories generally misunderstand how dance mechanically, attentively, and cognitively function. In most vernacular dance situations, even in tightly coupled partner dances, the movers orient their attention simultaneously towards their own body, the body of their partner(s), and the crowd.

Crowd attention is a crucial part of the dance experience. For one, if dancers are not attentively directed at the crowd, the dancing situation will collapse. Simply put, dancers will bump into each other, and the whole system will turn into an uncoordinated mess, leading to the breakdown of the activity. Here, simply think back to the last time you saw someone step on their partner's foot on a crowded dance floor. Furthermore, part of the enjoyment of dance, is the smooth coupling between oneself and the group. Wedding guests, clubgoers, concert attendees, jam participants, and so many more revel in not only their own coordination or the coordination with their partner but the experience of “our coordination.” Dancers revel in moving together as a group and being aware that “we” are moving together as a group. Many vernacular dances are not only in their cultural norms and philosophy about the attentive experience of community but the very way we must deploy our attention to perform these dances requires group-oriented attention. As an example, think here of dancing salsa with others in the park during a warm summer night. The magic of such an experience is not just that “you and I” dance, but that “we all” dance together under the stars.

If dance has developed primarily as a sexual selection mechanism, then our sensorimotor attention schemes would not be directed at collective experience. Instead, attention would be directed at singling people out. The cognitive processes at play in dance point to connection and group cohesion as the primary functions of dance. Strengthening human connection can, of course, lead to finding partners, but this is a fortunate byproduct of the much stronger evolutionary drive to survive through group cohesion (Christensen et al. 2017).

Extending the point of “we-experience” and dance culture, in most vernacular dances, there are social, cultural, and narrative mechanisms at play that make the dancers experience themselves as part of a living cultural community and a living historical legacy (Browning, 1995; Goldman, 2010; Salkind, 2018; Schloss, 2009; Talmon-Chvaicer, 2008). During dance, as an enculturated agent, the mover participates in a sub-cultural form of life (Kronsted, 2021). A dancer is not just casually breakdancing or voguing they enact their culture and community; they are a “B-boy” or they are “voguer” (DeFrantz, 2016; Schloss, 2009). In other words, attention in dance (even when abstract conceptual attention) is also directed at the crowd — In this case an even bigger crowd, namely the dancing community. The cultural, social, ethical, and historical reasons why people dance are facilitated by attentional processes that are crowd and community-oriented. On closer examination, these processes do not fit well with the dance-as-sexual-selection-thesis because this thesis requires single-agent-oriented attention.

Affect

Recent philosophy and cognitive science of emotion and affect demonstrates that in joint group activities such as dance affect and emotion are frequently jointly constructed (Krueger & Szanto, 2016; Slaby et al., 2019; Thonhauser, 2022). In line with research on the extended mind, this new affective cognitive science argues that in many cases, including dance, the affective profile could not have been achieved in isolation. Activities such as dance are better thought of as emergent joint affective systems (Kronsted, 2023; Slaby, 2014; Slaby et al., 2019). In such

systems, each agent is dynamically coupled and, therefore, simultaneously impacts one another. Because of the coupled nature of human social interaction, the affect is not experienced as “I have an emotion, and you happen to have the same emotion.” Rather, the affect is experienced as fused or joint “we are having an emotion” (Thonhauser, 2022). Like the process of attending, the emotional and affective profile of dancing is directed towards the collective rather than the identification of individuals who stand out from the group. Rather than experiencing individualized attention that can be identified as being held in common within each individual, the dancers are creating a fully *blended* affective experience. I am not having an emotion and you are having an emotion. Rather, we are having an experience in which the self-other distinction begins to break down — we are having an emotion (Kronsted, 2023).

This point of collectivity is important when thinking about the dance-as-sexual-selection-thesis. For the selection of a sexual partner with “good” genes is the requirement that one can, in fact, make selections based on how discrete agents make one feel. However, in many vernacular group dance scenarios, it is very much the group that creates the electric affective atmosphere and not necessarily any one individual. The intensity felt in a dance cypher, in a nightclub, at a swing session, during tango milongas, and more, are produced, felt by, and for the community. As other evolutionary scientists have also pointed out, dance seems to be affectively driven by and towards feelings of community building (Christensen et al., 2017). So, even in its affective profile, it seems that dance is more often than not driven towards community rather than eroticism. Dance is much more likely for strengthening group connection and we see that at play in its affective profile.

Joint Agency

Our conclusions so far that dance is for strengthening group connections are perfectly consistent with accounts of agency in dance. As humans dance together their experience of their own agency moves from an experience of individual agency to an experience of joint agency (an experience in which it is not quite clear who is generating the initiative, intentions, movement choices, etc. In other words, a fused experience of agency (Buttingsrud, 2021; Deans & Pini, 2022; Kimmel & Hristova, 2021; Kimmel & van Alphen, 2022; Kronsted, 2023). Such a move from individualized agency towards an experience of “we-agency” happens as dancers become increasingly dynamically synchronized through the process of entrainment (Knoblich & Sebanz, 2008; Kronsted, 2021; Salmela & Nagatsu, 2017; Tollefsen & Dale, 2011, 2018). We further see this phenomenon when we look at dance ecstasy and collective effervescence. In these cases, the structure of the agency is strongly experienced as a collective agency. In collective effervescence dancers often experience a sweeping sensation of becoming one with the crowd (Collins, 2014; Rimé & Páez, 2023). Such an experience erodes the self-other distinction and creates a collective experience of moving as one. Such experiences happen from intense overlapping processes of synchronization and entrainment (Schüler, 2017, Kronsted in Press.). An erosion of the self-other distinction is exactly the opposite of what dancing as an evolutionary mechanism would need to be genuinely about the identification of individuals with sexually competitive traits.

The overarching point is that the identification of sexually viable partners requires a process that focuses on the identification of individuals—individuals who stand out from the crowd. Such a process is the direct opposite of what we see our cognitive faculties doing when we are dancing, namely moving us towards experiencing being one with the crowd and creating social connection. Whether we look at culture, affect, agency, or attention in dance, the story is the same: vernacular dancing is cognitively structured to create social connection and coupling with collectives, not the identification of unique individual agents.

5. An Alternative Proposal — Self-Organization and Deep-Felt Connection in Dance

At this point, I have used significant page space arguing against the dance-as-sexual-selection-thesis. However, a strong objection usually doesn't do much unless it at least sketches a positive alternative. I do not have the page space to fully flesh out my alternative account. I will, however, provide at least the outline of an alternative to the sexual selection thesis, based in autopoietic embodiment and self-organization. We have looked at dance cultures, attention, affect, and agency, and in each case, dance seems to be directed at the communal. The conclusion so far is that dance seems to be more fundamentally for connection. I will deepen this point by showing how connection through dance is tied to some of our most fundamental bio-cognitive processes—the kind of processes that ensure our well-being and equilibrium with the world. To make this point, we must look at some complex arguments from enactive embodied cognition, in particular the connection between autopoiesis, cognition, and equilibrium. Here, we will see that dance is a particular kind of sensemaking that utilizes the embodied human need for environmental and social equilibrium. Rather than assuming that dance is a mating display, when we root dance in embodied sensemaking, we can understand dance as a movement technology that fosters and maintains social connection.

Autopoiesis

Autopoiesis (ancient Greek for self-production or self-making) is the process by which an organism perpetually re-creates itself through the creation of a boundary between itself and the environment (Di Paolo et al., 2018; Froese et al., 2023; Maturana & Varela, 1980). Autopoietic systems are systems in which each component perpetually constitutes and maintains the other components while being recursively constituted by those components. Each sub-system is mutually constraining and enabling so that each sub-system is dependent on one another for their continuation, falling into a meta-stable, self-organizing, self-perpetuating organization. This is true of each single-celled organism all the way to the complex organization of mammals, and of course, whole embodied dancing human agents. In the autopoietic arrangement, the organism achieves a distinct identity apart from its environment. Through self-production, the organism achieves *operational closure*:

Operational closure describes the organization of a network of mutually supporting processes such that each process in the network is enabled by other processes in the network and, in turn, each process in the network enables some other process(es) also in the network....Note that, contrary to what the term “closure” might suggest, an autonomous system remains structurally coupled to its environment and open to exchanges of all kinds; it is not self-isolated. Rather, the term “closure” is intended in the algebraic sense of a set of objects being closed under a given set of operators (Beer & Di Paolo, 2023, p. 2)

Full operational closure will mean the death of the organism. All active systems must take in energy from the environment. If a system is fully operationally closed it does not have an energy source and will dissipate. Put in layman's terms, the organism dies (think about not taking in food, water, or air). On the other hand, full operational openness also means the system will dissipate as it becomes absorbed into or overtaken by the environment (think, for example, of a decomposing body being eaten by microorganisms, moved piece by piece by the wind, or washed away by the rain). A fully open system has no integrity to keep itself intact.

A living system must be coupled with the environment and open enough to perturbations that it can be adaptive but not so open to perturbations that it loses its internal organization. Thus, to maintain itself, the living organism must constantly act on its environment to maintain the right *equilibrium* between operational openness and closedness (Beer & Di Paolo, 2023). Hence, the name “enactive” cognition. By being in constant physical commerce with the environment the organism maintains itself and shapes the environment (Gallagher, 2017; Malafouris, 2013). In this way, the organism continually enact its own existence.

While it is outside the scope of this paper to go into depths about the relationship between autopoiesis, enaction, and perception, it is generally said within this branch of cognitive science that living beings “bring forth a world” from their ongoing interactions with the environment (Di Paolo, 2023). That is, organisms act on the environment, which brings forth sensorimotor perception, which in turn causes the organism to create more movement to stay within coupled equilibrium with the environment (Di Paolo et al., 2017; Gallagher, 2017; Varela et al., 1991). Dancing, then, is a particular way of bringing forth a world and staying in equilibrium with that world. It is one kind of mode through which the organism can achieve sensorimotor coupling and fit between the organism and the world.

Notice the similarity between the basics of enactive cognition and perception and partnered dance. Dancing agents must constantly stay within the right balance of operational open and closedness. The dancer must be open to perturbations from their partners, while also having enough integrity to bring forth their intentions. Each dancer acts on the other to maintain the equilibrium of their joint system “the dance.” By acting on their partner, each dancer brings forth perceptions that present new possibilities for action to further bring the dance into existence (De Jaegher & Di Paolo, 2007; Hermans, 2015; Kronsted, 2021). The structure of vernacular dance mirrors the most fundamental structure of biological cognition, and as we will see shortly, this mirroring, also utilizes those processes to create a deep-felt sense of well-being.

The drive towards equilibrium develops a deep-felt existential sense that things are good when we are in equilibrium and bad when we are disequibrated (Colombetti, 2014). This sense of rightness is felt across multiple time scales and connected layers of existence — from the equilibrium within our cells to the equilibrium in our relationships with friends, family, and romantic partners (Di Paolo et al., 2018). Even equilibrium with one’s culture (Gallagher, 2020). Across all of these layers at various time scales, an organism must and will strive towards equilibrium, and our bodies are constantly affectively letting us know how well we are doing. In other words, all cognition is underpinned by and overlaid with affect — that affect provides a felt sense of how the organism is “doing” in the world (Colombetti, 2014; Maiese, 2016). Put more simply, there are things that are good for an organism and things that are bad for it, and from this basic experience of the world emerges a deep-rooted felt sense of being in or out of equilibrium with the world. There is a phenomenological, affective, often non-propositional experience of being in equilibrium with the environment (Colombetti, 2014). Dancing exploits this felt embodied sense of equilibrium by creating densely nested processes of synchronization between people so that we feel connected and in equilibrium with our physical and especially social environment.

When we dance, we often experience a great sense of pleasure, often with an existential dimension to that pleasure; “this experience I am having is meaningful.” This is the body’s way of understanding itself as being in equilibrium with its environment—in this case, a social environment. The fact that we feel “existential” or meaningful positive affect when we dance with others points to dance as being functionally for social connection. It is an activity that utilizes embodied forms of sensemaking to create social equilibrium. Dance has likely evolved

to create and strengthen social connections, and the way it does this is (amongst others) by bringing the organism into equilibrium with its social environment.

Self-Organization

As we see from our brief discussion of autopoiesis, living is an inherently cognitive process (Di Paolo et al., 2017; Froese, 2021; Thompson, 2007; Varela et al., 1991). All living organisms undergoing autopoiesis must, because of their inherently precarious existence, strive to bring themselves into equilibrium with their environments across short-term and long-term dynamics by being in constant coupling with the environment. Our most fundamental mode of existing as living cognitive beings is coupled action with the environment to bring the agent environment coupled system into equilibrium. There is a biologically built-in telos towards an equilibrium that emerges from the organization of the autopoietic body. Importantly, such an equilibrium is most typically achieved through self-organizing processes:

A self-organizing system is a system that exhibits regularities that arise without a plan or leader but emerge from the interactions of the parts of the system. The posit that human action is self-organizing began the recent resurgence of interest in dynamical systems models in psychology (Kugler et al., 1980). Dynamical systems models work by assuming that thinking, experiencing, acting humans are self-organizing systems that comprise portions of their brains, bodies and tools. Self-organizing systems have their organization without a plan or controller (Feiten et al., 2023, p. 314).

Chemical binding, single cells, multicellular organisms, sand-dune assemblage, snowflake patterns, whirlpools, convection patterns, anthills, animal milling, bird flocking, fish schools, pedestrian behavior, and thousands of other processes are all examples of self-organizing systems. Self-organization is a ubiquitous phenomenon across the natural world, ranging from rapid dynamics at minute levels of analysis to macro interactions across slow time scales (Camazine et al., 2020).

A large literature within the cognitive sciences have since the introduction of dynamic systems theory consistently shown that human behavior itself, consists of perpetual loops of self-organizing sensorimotor loops (Beer, 2024; Chemero, 2009; Kelso, 1995, 2021). Through coupled synchronization human actions self-organize into recursive patterns of meaningful behavior (De Jaegher et al., 2010). For example, learning how to reach, grab, and bring food to mouth, using the vocal cord, walking and running, conversation, lying and deception, and so many more of our fundamental critical behaviors rely on self-organizing sensorimotor loops (Kelso, 1995, 2016; Thelen & Smith, 1994; van Dijk & Rietveld, 2017).

Importantly human dancing itself has been shown to also rely on a myriad of dynamic synchronization processes and sensorimotor loops that self-organize into an ongoing participatory system (Kronsted & Gallagher, 2021). Many of the processes we consider part of successful dancing are a matter of using synchronization processes to create equilibrium through self-organization. If this seems a bit abstract think about the way that over time as we dance with people not only do our legs fall into synch with the rhythm and each other, but so do hips, torso, hands, shoulders, heads, gaze patterns, breathing, and pretty much any other body part or bodily mechanism we can think of. A “good” dancing couple is one that falls into polyrhythmic relationships that are in self-organized equilibrium with each other and the whole dance space.

The point that I hope is emerging, is that vernacular dancing exploits the body’s innate

need to experience self-organized equilibrium. Vernacular dancing likely feels good, at a deep visceral level, because it taps into one of our most ancient mechanisms. Sensorimotor coupling, synchronization, self-organization, and equilibrium are all the basic building blocks of our bio-cognitive existence, and dancing explicitly utilizes and magnifies these processes. Unlike many competitive sports in which players have to trick, overcome, and beat the other player by bringing them out of equilibrium, dance is all about continually intensifying the depth, intensity, and number of synchronizing, self-organizing processes. In short, vernacular dance aims for an intense experience of embodied equilibrium and thereby taps into our most fundamental sense of well-being. It is no wonder that so much language around dance ends up having a spiritual lean (Midgelow, 2018). It is hard to linguistically explain the feeling of embodied equilibrium since it is so fundamental.

Dance has likely evolved as a tool for social connection, by magnifying and multiplying embodied relationships of synchronization and self-organization. We must remember that being in equilibrium is also being so with one's social and cultural environment (Gallagher, 2020). When we dance, we also organize into multilayered perpetuating self-organizing relations of synchronization with others, the music, and ourselves. This, in turn, creates a pleasurable, meaningful connection with others and the community. We cannot forget that synchronization and self-organization function through structural coupling (that is making one system causally interconnected with another). This kind of coupling makes us feel and be connected with others, and being connected with others is crucial for the organism's thriving and continuation.

In sum, we have seen that from the perspective of enactive cognitive science, coupling and self-organization are involved at every scale of analysis — from the most fundamental processes in our cells scaling up all the way to multi-agent interactions. Given this fact, it should be no surprise that so many vernacular dances create deep feelings of well-being. When we dance, we are explicitly rarefying and using the most fundamental mechanisms that our system is telling us are good for us. Tapping into a primordial sense of embodied normative correctness; correctness that is tied to connecting with the environment and with others. While dance is not primarily about sexual selection, it is very much for social connection.

References

- Beer, R. D. (2024). On the Proper Treatment of Dynamics in Cognitive Science. *Topics in Cognitive Science*, n/a(n/a). <https://doi.org/10.1111/tops.12686>
- Beer, R. D., & Di Paolo, E. A. (2023). The theoretical foundations of enaction: Precariousness. *Biosystems*, 223, 104823. <https://doi.org/10.1016/j.biosystems.2022.104823>
- Borelli, M. B., & Monroe, R. (2014). *The White Girl in the Middle* (Vol. 1). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199897827.013.013>
- Brown, W. M., Cronk, L., Grochow, K., Jacobson, A., Liu, C. K., Popović, Z., & Trivers, R. (2005). Dance reveals symmetry especially in young men. *Nature*, 438(7071), 1148–1150.
- Browning, B. (1995). *Samba: Resistance in Motion*. Indiana University Press. [https://ebookcentral.proquest.com/lib/\[SITE_ID\]/detail.action?docID=4955896](https://ebookcentral.proquest.com/lib/[SITE_ID]/detail.action?docID=4955896)
- Buttingsrud, C. (2021). Bodies in skilled performance: How dancers reflect through the living body. *Synthese*, 199(3), 7535–7554.
- Camazine, S., Deneubourg, J.-L., Franks, N. R., Sneyd, J., Theraula, G., & Bonabeau, E. (2020). Self-organization in biological systems. *Self-Organization in Biological Systems*. Princeton

university press.

Chemero, A. (2009). *Radical embodied cognitive science*. MIT Press. http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=018633962&sequence=000003&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA

Christensen, J. F., Cela-Conde, C. J., & Gomila, A. (2017). Not all about sex: Neural and biobehavioral functions of human dance. *Annals of the New York Academy of Sciences*, 1400(1), 8–32. <https://doi.org/10.1111/nyas.13420>

Collins, R. (2014). Interaction ritual chains and collective effervescence. *Collective Emotions*, 299–311.

Colombetti, G. (2014). *The Feeling Body*. Mit Press. <https://doi.org/10.7551/mitpress/9780262019958.001.0001>

Darwin, C. (1872). *The descent of man, and selection in relation to sex* (Vol. 2). D. Appleton.

De Jaegher, H., & Di Paolo, E. (2007). Participatory sense-making. *Phenomenology and the Cognitive Sciences*, 6(4), 485–507. <https://doi.org/10.1007/s11097-007-9076-9>

De Jaegher, H., Paolo, E. D., & Gallagher, S. (2010). Can social interaction constitute social cognition? *Trends in Cognitive Sciences*, 14(10), 441–447. <https://doi.org/10.1016/j.tics.2010.06.009>

Deans, C., & Pini, S. (2022). Skilled performance in Contact Improvisation: The importance of interkinaesthetic sense of agency. *Synthese*, 200(2), 1–17.

DeFrantz, T. F. (2016). Bone-breaking, black social dance, and queer corporeal orature. *The Black Scholar*, 46(1), 66–74.

Di Paolo, E. (2023). F/acts Ways of Enactive Worldmaking. *Journal of Consciousness Studies*, 30(11–12), 159–189.

Di Paolo, E., Buhrmann, T., & Barandiaran, X. (2017). *Sensorimotor life* (First edition). Oxford University Press. http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=029440829&sequence=000001&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA

Di Paolo, E., Cuffari, E. C., & De Jaegher, H. D. (2018). *Linguistic bodies*. The MIT Press.

Ehrenreich, B. (2007). *Dancing in the Streets: A History of Collective Joy*. Macmillan.

Favela, L. H., & Chemero, A. (2023). Plural Methods for Plural Ontologies: A Case Study from the Life Sciences. In *Situated Cognition Research: Methodological Foundations* (pp. 217–238). Springer.

Feiten, T. E., Peck, Z., Holland, K., & Chemero, A. (2023). Constructive constraints: On the role of chance and complexity in artistic creativity. *Possibility Studies & Society*, 27538699231193539.

Fink, B., Bläsing, B., Ravignani, A., & Shackelford, T. K. (2021). Evolution and functions of human dance. *Evolution and Human Behavior*, 42(4), 351–360.

Franko, M. (2015). *Dance as Text Ideologies of the Baroque Body*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199794010.001.0001>

Froese, T. (2021). *To understand the origin of life we must first understand the role of normativity*.

- Froese, T., Weber, N., Shpurov, I., & Ikegami, T. (2023). From autopoiesis to self-optimization: Toward an enactive model of biological regulation. *bioRxiv*, 2023.02. 05.527213.
- Gallagher, S. (2017). *Enactivist Interventions: Rethinking the Mind* (Kindle Edition). Oxford University Press.
- Gallagher, S. (2020). *Action and Interaction* (1st ed.). Oxford University Press. <https://doi.org/10.1093/oso/9780198846345.001.0001>
- Gaunt, K. D. (2015). YouTube, twerking & you: Context collapse and the handheld co-presence of black girls and Miley Cyrus. *Journal of Popular Music Studies*, 27(3), 244–273.
- Gavanas, A. (2008). Grasping Communitas. *Ethnos*, 73(1), 127–133. <https://doi.org/10.1080/00141840801927566>
- Goldman, D. (2010). *I Want to Be Ready: Improvised Dance as a Practice of Freedom*. University of Michigan Press. http://gateway.proquest.com/openurl?ctx_ver=Z39.88-2003&xri:pqil:res_ver=0.2&res_id=xri:ilcs-us&rft_id=xri:ilcs:rec:abell:R04364455
- Halliday, A. S. (2020). Twerk sumn!: Theorizing Black girl epistemology in the body. *Cultural Studies*, 34(6), 874–891.
- Hermans, C. (2015). *Of Movements And Affects: Dance Improvisation As Participatory Sense Making Activity* (C. Hermans & M. Bremmer, Eds.; pp. 4–14).
- Henrich, J. Heine, S. J., Norenzayan, A. (2010). The Weirdest People in the World? The Behavioral and Brain Sciences 33 (2–3): 61–83.
- Hugill, N., Fink, B., & Neave, N. (2010). The role of human body movements in mate selection. *Evolutionary Psychology*, 8(1), 147470491000800107.
- Hugill, N., Fink, B., Neave, N., Besson, A., & Bunse, L. (2011). Women's perception of men's sensation seeking propensity from their dance movements. *Personality and Individual Differences*, 51(4), 483–487.
- Hye-jin, L., Seung-Ho, J., Sang-Yeol, L., & Kyu-Sic, H. (2015). Effectiveness of Dance/Movement Therapy on Affect and Psychotic Symptoms on Patients with Schizophrenia. *The Arts in Psychotherapy*, 64–68.
- Kelso, S. (1995). *Dynamic patterns: The self-organization of brain and behavior*. MIT press.
- Kelso, S. (2016). On the Self-Organizing Origins of Agency. *Trends in Cognitive Sciences*, 20(11), 868. <https://doi.org/10.1016/j.tics.2016.08.011>
- Kelso, S. (2021). The Haken–Kelso–Bunz (HKB) model: From matter to movement to mind. *Biological Cybernetics*, 115(4), 305–322.
- Kimmel, M., & Hristova, D. (2021). The micro-genesis of improvisational co-creation. *Creativity Research Journal*, 1–29.
- Kimmel, M., & van Alphen, F. (2022). The spectrum of distributed creativity: Tango dancing and its generative modalities. *Psychology of Aesthetics, Creativity, and the Arts*.
- Kitata, M. (2020). Sexualising the performance, objectifying the performer: The twerk dance in Kenya. *Agenda*, 34(3), 11–21.
- Knoblich, G., & Sebanz, N. (2008). Evolving intentions for social interaction: From entrainment to joint action. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1499),

2021–2031. <https://doi.org/10.1098/rstb.2008.0006>

Koch, S. C., Mehl, L., Sobanski, E., Sieber, M., & Fuchs, T. (2015). Fixing the mirrors: A feasibility study of the effects of dance movement therapy on young adults with autism spectrum disorder. *Autism*, 19(3), 338–350.

Kronsted, C. (2018). The self and dance movement therapy – a narrative approach. *Phenomenology and the Cognitive Sciences*. <https://doi.org/10.1007/s11097-018-9602-y>

Kronsted, C. (2021). *An Enactivist Model of Improvisational Dance*. The University of Memphis.

Kronsted, C. (2023). Can't stop, won't stop—an enactivist model of Tarantism. *Phenomenology and the Cognitive Sciences*, 1–25.

Kronsted, C., & Gallagher, S. (2021). Dances and Affordances: The Relationship between Dance Training and Conceptual Problem-Solving. *The Journal of Aesthetic Education*, 55(1), 35–55. <https://doi.org/10.5406/jaesteduc.55.1.0035>

Krueger, J., & Szanto, T. (2016). Extended emotions. *Philosophy Compass*, 11(12), 863–878.

Levine, B., & Land, H. M. (2016). A meta-synthesis of qualitative findings about dance/movement therapy for individuals with trauma. *Qualitative Health Research*, 26(3), 330–344.

Lilly, M., Thomas, F., C, K. S., & Dusan, H. (2016). Overcoming Disembodiment: The Effect of Movement Therapy on Negative Symptoms in Schizophrenia—A Multicenter Randomized Controlled Trial. *Frontiers in Psychology*. <https://doi.org/10.3389/fpsyg.2016.00483>

Lundy, A. D. (2018). Caught between a thot and a hard place: The politics of Black female sexuality at the intersection of cinema and reality television. *The Black Scholar*, 48(1), 56–70.

Maiese, M. (2016). *Embodied Selves and divided Minds* (1st ed.). Oxford University Press.

Malafouris, L. (2013). *How things shape the mind*. MIT Press.

Malbon, B. (2002). *Clubbing: Dancing, ecstasy, vitality*. Routledge.

Maturana, H. R., & Varela, F. J. (1980). *Autopoiesis and cognition* (Vol. 42). Reidel. http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=003161085&sequence=000001&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA

McCarty, K., Darwin, H., Cornelissen, P. L., Saxton, T. K., Tovée, M. J., Caplan, N., & Neave, N. (2017). Optimal asymmetry and other motion parameters that characterise high-quality female dance. *Scientific Reports*, 7(1), 42435.

McCarty, K., Hönekopp, J., Neave, N., Caplan, N., & Fink, B. (2013). Male body movements as possible cues to physical strength: A biomechanical analysis. *American Journal of Human Biology*, 25(3), 307–312.

Metin, C., & Tekozel, M. (2024). Elephant on the Dance Floor: Revealing the Significance of Dancers' Sex in Coalition Quality Assessments. *Evolutionary Psychological Science*, 1–11.

Midgelow, V. (2018). *Back To Dance Itself—Phenomenologies of the Body in Performance* (S. Fraleigh, Ed.; 1st ed.). University of Illinois Press.

Millman, L. M., Terhune, D. B., Hunter, E. C., & Orgs, G. (2021). Towards a neurocognitive approach to dance movement therapy for mental health: A systematic review. *Clinical Psychology*

✂ *Psychotherapy*, 28(1), 24–38.

Montero, B. G. (2016). *Thought in Action—Expertise and the Conscious Mind* (1st ed.). Oxford University Press.

Mpofu, S. (2022). Booty power politics: The social-mediated consumption of black female bodies in popular culture. *Journal of African Cultural Studies*, 34(2), 186–204.

Ovalle, P. P. (2011). *Dance and the Hollywood Latina: Race, sex, and stardom*. Rutgers University Press.

Pakes, A. (2020). *Choreography invisible*. Oxford University Press. <https://doi.org/10.1093/oso/9780199988211.001.0001>

Ravn, S. (2020). Investigating Dance Improvisation: From Spontaneity to Agency. *Dance Research Journal*, 52(2), 75–87. <https://doi.org/10.1017/S0149767720000182>

Rimé, B., & Páez, D. (2023). Why We Gather: A New Look, Empirically Documented, at Émile Durkheim's Theory of Collective Assemblies and Collective Effervescence. *Perspectives on Psychological Science*, 17456916221146388.

Robinson, L. H. (2023). Mass Media and Social Circulations of Popular Dance. In *Dance in US Popular Culture* (pp. 221–233). Routledge.

Röder, S., Carbon, C.-C., Shackelford, T. K., Pisanski, K., Weege, B., & Fink, B. (2016). Men's visual attention to and perceptions of women's dance movements. *Personality and Individual Differences*, 101, 1–3.

Salkind, M. (2018). *Do You Remember House?* Oxford University Press. <https://doi.org/10.1093/oso/9780190698416.001.0001>

Salmela, M., & Nagatsu, M. (2017). How does it really feel to act together? Shared emotions and the phenomenology of we-agency. *Phenomenology and the Cognitive Sciences*, 16, 449–470.

Schloss, J. (2009). *Foundation* (1st ed.). Oxford University Press.

Schüler, S. (2017). *Aesthetics of Immersion: Collective Effervescence, Bodily Synchronisation and the Sensory Navigation of the Sacred*.

Slaby, J. (2014). Emotions and the extended mind. *Collective Emotions*, 2014, 32–46.

Slaby, J., Mühlhoff, R., & Wüschner, P. (2019). Affective arrangements. *Emotion Review*, 11(1), 3–12.

Solveig, W., & Sabine, K. (2017). Active factors in dance/movement therapy: Specifying health effects of non-goal-orientation in movement. *The Arts in Psychotherapy*, 52, 10–23. <https://doi.org/10.1016/j.aip.2016.09.004>

St John, G. (2004). *Rave culture and religion* (Vol. 8). Routledge London.

St John, G. (2006). Electronic dance music culture and religion: An overview. *Culture and Religion*, 7(1), 1–25.

Talmon-Chvaicer, M. (2008). *The hidden history of capoeira: A collision of cultures in the Brazilian battle dance*. University of Texas Press.

Thelen, E., & Smith, L. B. (1994). *A dynamic systems approach to the development of cognition and action*. The MIT Press. <http://cognet.mit.edu/book/dynamic-systems-approach-to-development->

of-cognition-and-action

Thompson, E. (2007). *Mind in life*. Harvard Univ. Press. http://bvbr.bib-bvb.de:8991/F?func=service&doc_library=BVB01&local_base=BVB01&doc_number=015588211&sequence=000001&line_number=0001&func_code=DB_RECORDS&service_type=MEDIA

Thonhauser, G. (2022). Towards a taxonomy of collective emotions. *Emotion Review*, 14(1), 31–42.

Thonhauser, G., & Wetzels, M. (2020). Emotional sharing in football audiences. *Emotions in Sport and Games* (pp. 110–129). Routledge.

Tollefsen, D., & Dale, R. (2011). Naturalizing joint action: A process based approach. *Philosophical Psychology*. <https://doi.org/www.tandfonline.com/doi/abs/10.1080/09515089.2011.579418>

Tollefsen, D., & Dale, R. (2018). *Joint Action and 4E Cognition* (S. Gallagher & A. Newen, Eds.; 1st ed.). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780198735410.013.13>

van Dijk, L., & Rietveld, E. (2017). Foregrounding Sociomaterial Practice in Our Understanding of Affordances: The Skilled Intentionality Framework. *Frontiers in Psychology*, 7. <https://www.frontiersin.org/article/10.3389/fpsyg.2016.01969>

Varela, F., Rosch, E., Kabat-Zinn, J., & Thompson, E. (1991). *The Embodied Mind: Cognitive Science and Human Experience*. Mit Press. [https://ebookcentral.proquest.com/lib/\[SITE_ID\]/detail.action?docID=4786460](https://ebookcentral.proquest.com/lib/[SITE_ID]/detail.action?docID=4786460)

