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Interactive expertise in solo and joint musical performance

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Abstract

The paper presents two empirical cases of expert musicians-a classical string quartet and a solo, free improvisation saxophonist-to analyze the explanatory power and reach of theories in the field of expertise studies and joint action. We argue that neither the positions stressing top-down capacities of prediction, planning or perspective-taking, nor those emphasizing bottom-up embodied processes of entrainment, motor-responses and emotional sharing can do justice to the empirical material. We then turn to hybrid theories in the expertise debate and interactionist accounts of cognition. Attempting to strengthen and extend them, we offer 'Arch': an overarching conception of musical interaction as an externalized, cognitive scaffold that encompasses high and low-level cognition, internal and external processes, as well as the shared normative space including the musical materials in which the musicians perform. In other words, 'Arch' proposes interaction as a multivariate multimodal overarching scaffold necessary to explain not only cases of joint performance, but equally of solo improvisation.

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Keywords: Musicianship; Expertise; Mesh; Joint Action; Interaction as Scaffold; Phenomenological Interviews.

1)Introduction

This paper presents two case studies of expert musicianship, one of joint performance and one of solo performance, to defend two claims. Focusing on the first case study, the first claim is that we can conceive of such expertise as an interactional skill, in which interaction itself, considered as an externalized, extended, and scaffolded cognitive system, constitutes a singular overarching structure enveloping both low level and high level cognitive capacities. Our second claim and more radical claim, is that musical expertise even in the case of solo performance can be understood as an interactional skill, in which one enacts several agential poles in order to achieve a successful solo improvisation.

The literature on "expertise" as well as that on the nature of joint action in social ontology seems to be analogously divided into accounts that stress low-level, unconscious or, automatic self-regulatory mechanisms, versus accounts that stress high-level metacognitive and planning skills. In the expertise debate, we find a dichotomy between the "mindlessness" or "automaticity" accounts of Dreyfus and others (Dreyfus 2005; Beilock & Carr 2001). They claim that reflection degrades coping (Dreyfus 2005; 2013), and that self-reflection or attention to one's own body interferes with the automaticity or proceduralization that defines expertise (Beilock &Carr 2001; Beilock 2011). On the opposite side, other authors stress that expertise is pervasively characterized by deliberation, planning and reflection

(Montero 2016). In social ontology, high-level accounts stress the necessity of mind-reading capacities, common knowledge or theory-building in order to understand others when acting together with them (Bratman 1992, Tomasello 2014), while others claim that minimal bodily and brain-based processes of mirroring and entrainment suffice for our engagement with others (Butterfill 2012; 2013 Knoblich, Günther et al. (2011). In both domains, accounts attempting to integrate the two poles are emerging. In social ontology, a number of proposals have stressed the need for a layered account of shared intentionality that encompasses intermediate levels of cognitive complexity or jointness (e.g. Schmitz 2016 , Ludwig 2016 and Satne 2019). In the expertise domain, Christensen, Sutton, and McIlwain have suggested a "Meshed" model that integrates the domains of the high-level, reflective and representational with the reflex-like, quick and bodily (Christensen, Sutton and McIlwain 2016). While we align ourselves with these strategies that have tried to combine or take into account both low-level and high-level cognitive mechanisms both in the domain of expertise and joint action, we find some vagueness in Christensen, Sutton et al's proposal pertaining to the exact nature of the "integration" of levels it offers. Further, the model does not (yet) treat the explanatory potential of cognitively scaffolding interaction, and hence our focus intends to develop and expand the explanatory reach of "Mesh" and provide a more encompassing view that incorporates individual processes, shared strategies and external materials into a single overarching structure of interaction, thus we label this conception "Arch" rather than "Mesh". Our focus on interaction is also in line with the enactivist or "interactionist" trend in philosophy of mind (De Jaegher & Di Paolo 2007; De Jaegher, Di Paolo & Gallagher 2010). This position shares the focus on the sufficiency of minimal coordination with Butterfill et al's proposal just mentioned and stresses mutual adaptation and mutual tracking when accounting for interaction. Their claim is more radical though, stating that "there is no cognition without interaction" and that "interactive processes […] can complement and even replace individual mechanisms" (De Jaegher, Di Paolo and Gallagher 2010, 441). In other words, interactionism claims that the processes constituting cognition are themselves interactive. This paradigm has provided important evidence that spontaneous coordination unfolds in stable patterns among agents in interaction and describes these interactive processes as unique dynamical systems themselves constituted by autonomous systems in interaction (ibid). We find, however, that the exclusive focus on very basic forms of interaction and their constitution in a dynamical system leaves it open and unclear how to scale up and include more sophisticated mental acts of self-reflection and planning for instance.

Our account is based on two case studies, in the form of qualitative, "phenomenological" interviews (Høffding & Martiny 2016) with a string quartet and with an improvising saxophonist (Høffding 2019; Høffding & Schiavio 2019). Linking these interviews to the two aforementioned theoretical domains, those of expertise and joint action, we first explore the kind of expertise that goes into performing together as a tightly knit group, thus expanding the expertise theories that so far mostly has focused on individual action. Second, turning to the case of solo jazz improvisation, we show how this is an inherently interactive process in which one must enact several external agential poles in order to achieve a successful solo improvisation. Both cases bear on incredibly fast processes informed by bodily non-propositional knowledge as well as on sophisticated mental actions of seeing and hearing oneself from external perspectives, planning into the future and drawing on musical references. We believe that a scaffolded structure of interaction can most parsimoniously account for these complex musical

actions. In other words, we take interaction to work as an overarching structure that smoothens and facilitates the musical unfolding for both the string quartet and the solo sax player. Hence, we propose interactionism not as a position "in between" the reflective, top-down and the bodily, bottom-up accounts, but as a framework that encompasses both and in a single account can span both poles without needing recourse to an additional explanatory link between two levels.

2) The expertise debate

The so-called expertise debate is largely about whether thinking interferes with acting. A number of philosophers hold and have held the belief that it does, also voiced in sports psychology as the advice that expert athletes and artists ought to avoid thinking too much about the actions they are about to perform (Beillock & Carr 2001; Beilock 2011). This will degrade the fluency of their actions (Dreyfus 2005; 2013) or even lead to a complete breakdown of the action also known as "choking" (see Cappucio 2015). A debated proponent of this position is Hubert Dreyfus, with his five-stage model of expertise (2014) and his articles concerning the relation between expert coping and reflection (2005; 2013). His position has been thoroughly discussed for instance by Breivik 2013, Sutton et al. 2011, Fridland 2014, Dow 2017, Montero 2016, and Høffding 2019, and we will not rehearse further criticism here. A seemingly parallel line of thinking emerges from so-called "Eastern perspectives"; philosophies of martial arts systems from China and Japan, where one, while in some form of "flow" or meditative state, putatively loses self-awareness (Hutto & Ilundáin-Agurruza 2018, Ilundáin-Agurruza 2015, De Prycker 2011).

In her recent book *Thought in Action, expertise and the conscious mind*, Barbara Montero gives a detailed overview of these positions and offers poignant analytic retaliation. As a former professional ballet dancer, she believes that most of the "mindlessness" accounts of expertise mentioned above are mythical constructions and persistently argues that we tend to underrate the speed of reflection and that such reflection is instrumental to the development and maintenance of expertise. She also engages with the Chinese and Japanese intuitions and rather persuasively shows that much of their reception in "the West" can be traced back to the now classic *Zen and the Art of Archery* (Herrigel 1989), in which theoretically central conclusions are drawn from dubious understanding or probable misinterpretations of a Zen archer master's words (Montero 2016, Chap. 1). Her positive contribution consists in defending a claim called "cognition-in-action":

> For experts, when all is going well, optimal or near optimal performance frequently employs some of the following conscious mental processes: self-reflective thinking, planning, predicting, deliberation, attention to or monitoring of their actions, conceptualizing their actions, control, trying, effort, having a sense of the self, and acting for a reason. Moreover, such mental processes do not necessarily or even generally interfere with expert performance, and should not generally be avoided by experts. (2016, 38)

Montero gathers all sorts of empirical evidence for her position, generally showing that, indeed, thinking does not degrade coping and that expertise cannot come about without the abovementioned cognitively sophisticated mental processes.

This intellectual landscape calls for critical, integrative work. It cannot be that thinking both interferes with and enables as well as enhances expert coping, not at least without further clarification of how these different outcomes are possible and why and when they occur.[1] Our attempt in this paper is to point to extended, interactive cognitive and embodied structures that can incorporate cognition-in-action, but also to account for how expert action is sometimes brought about without such high individual cognitive demands. In this, our proposal is not unlike John Sutton, Wayne Christensen and colleagues' endeavor to provide a "Meshed" account of expert action.

In a number of papers, Christensen and Sutton begin to provide the groundwork for an integrated conception of expert skill (Christensen, Sutton and McIlwain 2015; 2016; Christensen et al. 2015). They review existing accounts that are categorized – analogously to the above exposition – as "automatic" or "full cognitive" and suggest Mesh as a hybrid theory. Identifying nine desired expertise *explananda*, namely "(i) reduced attention, (ii) multi-task tolerance, (iii) disruptive attention, (iv) reduced cognitive effort, (v) reduced memory, (vi) strategic focus, (vii) action slip, (viii) increased attention in response to challenge, (ix) increased cognitive effort in response to challenge" (Christensen, Sutton & McIlwain 2016, 45-6) they show how Mesh, as opposed to for instance "automatic" or "full cognitive" provides *explanan*s for all nine. Including the earlier "AIR" (Applying Intelligence to the Reflexes: Geeves et al. 2014; Sutton et al. 2011) work, the authors draw on qualitative interviews with and observations of expert musicians, mountain bikers and cricket players integrated with empirical work from sports psychology, cognitive science, and neuroscience. They conceive of Mesh as a "hybrid view" and propose "that controlled and automatic processes are closely integrated in skilled action, and that cognitive control directly influences motor execution in many cases." (Christensen, Sutton and McIlwain 2016, 43). One way of conceptualizing such a hybridization is to nuance the very notion of "control". Whereas in "automatic" and "full cognitive" control is an all-or-nothing matter, they suggest a partition into "smooth control", "adaptive control", and "effortful problem solving" that each shade into one another (ibid., 52). Such conceptual work helps resolve the dichotomies that haunt the expertise debate and is compatible with other phenomenologically informed expertise accounts for instance of how musicians employ different kinds of control functions in musical interaction (Salice, Høffding & Gallagher 2017).

While we generally endorse Mesh, there remains some unclarity to its exact nature: is Mesh a framework that integrates two other frameworks, or is it in itself is an integrated framework that envelops, replaces or overrides the others? The term "hybrid" is ambiguous. A hybrid can be a singular phenomenon that embeds properties of other phenomena into itself, in the way that an okapi could be conceived of as a hybrid of a zebra and a giraffe. A hybrid, however, can also be a meta-system that switches between two or more primary systems, in the way a hybrid car switches between running on gasoline and electricity. In the former case, the hybrid is integrated insofar as there only is one

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[1] Ellen Fridland makes the same observation, but suggests a path toward resolution that differs from ours, we discuss this below. See also Fridland 2014; 2017a;2017b.

homeostatic system or organism, namely the okapi. The okapi is not made up of one giraffe-part and one zebra-part. In the latter case, the hybrid car relies on two separate systems, the electric and the gasoline system, and is integrated in a different sense of the word, insofar as it uses these two systems alternately to effectuate locomotion. Applied to the present investigation, the ambiguity here amounts to conceiving of expertise as either a secondary system that builds links between the primary systems of top-down and bottom-up, or thinking of it as the construction of a new primary system that is inherently self-integrated in the homeostatic sense of the word illustrated by the okapi example. We think that Sutton, Christensen and colleagues, inspired by neuroscientific evidence, conceive of Mesh as integrated in the former sense, like a hybrid car. Relying more on the phenomenology of experts' experience, we, perhaps in contrast, want to remain open to the latter conception and think of interaction as a singular self-integrating structure that develops together with, or as part of, expertise.

Well aligned with the Mesh proposal, we find Ellen Fridland's work. In a number of papers, she convincingly argues against understanding skill through dichotomies such as (propositional) intelligent vs. (bodily) unintelligent processes (Fridland 2017a) and automaticity vs. control (Fridland 2017b), showing that trying to integrate such dichotomized concepts fails to explain the empirical literature on the psychology of skill. Though introducing a layered view of different kinds of control (Fridland 2014), her account mostly remains a negative contribution, highlighting the problems in Dreyfus', David Papineau's and Jason Stanley's dichotomizations. She acknowledges that her account must face up to the "interface problem", namely the problem of how to relate the intermediate levels of cognition between the brute bodily, and the sophisticated propositional (Fridland 2017b, 1557)[2]. Opposed to Mesh, Fridland remains individualistic, as she does not (yet) address the cognitive potential of interactive and scaffolded resources, which we believe should be used in overcoming the interface problem.[3] When we from now on home in on these resources in an attempt to expand the Mesh model, we believe that this spills over to Fridland's postion. Hence, from here on we frame our analysis as a response to Mesh.

In a forthcoming follow-up to the recent Mesh publications, Sutton and Christensen claim allegiance to anti-individualism and anti-internalism (Christensen and Sutton, forthcoming). They further claim that cognition is structured for the demands of interaction and that task control is distributed across body and world (ibid.). This is a welcome, but slightly surprising development. Surprising, because the notions of extended and embodied cognition are not mentioned in the theory building Mesh papers from 2015 and 2016. We are curious to know how Mesh conceives of the role of interaction as cognitively foundational in their hybrid model. Our positive contribution based on expert musicians both backs and extends the reach of the Mesh. Methodically it is certainly compatible, emphasizing "cognition in the wild" (Christensen and Sutton, forthcoming) over and above lab-experiments that often fall short on ecological validity (Christensen, Sutton and McIlwain 2015)

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2 The "interface problem" was first presented in Butterfill & Sinigaglia 2014; see also Mylopoulos & Pacherie 2017).

3 While spelling out in detail how "Arch" specifically overcomes the interface problem, is not something we purport to be doing here, but must be left for another paper, below we do provide the key reasons why "Arch" does not prima facie confront an "interface problem" between high and low level cognition.

We recognize that we are not the first to turn to interaction as a framework for music performance. Enactivism primarily of the kind heralded by Gallagher, De Jaegher, and Di Paolo (cfr. De Jaegher, Di Paolo and Gallagher 2010, Gallagher 2017) has become popular in music studies of philosophical (Krueger 2009; 2014) and psychological nature (Schiavio and Cummins 2015; Schiavio et al. 2017; Schiavio & De Jaegher 2017).[4] In a chapter on music and empathy in the context of interactionism, van der Schyff and Krueger provide a comprehensive overview of publications in the emerging field of 4E cognition music studies. In several places mentioning the integration of top-down and bottom-up processes, they write about emotions that:

> they are increasingly explored as dynamic phenomena that span an integrated brain-body-world system. Importantly, this research highlights the active and self-organizing nature of emotional experience as it develops across bodily, neural, ecological and temporal dimensions. (van der Schyff & Krueger, forthcoming)

Here, "integration" is used in the aforementioned "homeostatic" sense of the word, as "self-organizing".[5] What van der Schyff and Krueger attempt to do for empathy in emotion, namely develop it along 4E cognition lines, with a focus on interaction, we now suggest to do for expertise.

3) Case I: How do you play together?

The Danish String Quartet (DSQ) is a Danish chamber music ensemble consisting of Frederik Øland (violin), Rune Tonsgaard (violin), Asbjørn Nørgaard (viola), and Fredrik Sjölin (cello). They began playing together in their teenage years and have risen to international fame for their intense performances of most of the classical string quartet repertoire as well as their Nordic folk music. As most professional classic musicians today, they all started practicing before turning eight and have since practiced on average for several hours most days ever since (as of 2018, they are between 34 and 37 years old). It is difficult to know precisely how many hours, thirty such years of practice amounts to, but a good estimate lies between 20-30.000 hours at least half of which they have practiced and performed together. Coming across a group of four people who have used well over 10.000 hours painstakingly perfecting the smallest of details in a collaboration as complex and intricate as a string quartet, provides a unique chance to study processes of shared intentionality. In fact, no words or theories can scale up to the experience of seeing such an ensemble perform, but thorough phenomenological interviews can give a decent insight into the minds and bodies working in such an ensemble.

The following data is based on several years of investigations and interviews together with the DSQ amounting to about 17 interview hours. The theory, methodology and pragmatics behind combining a philosophical or phenomenological inquiry with a qualitative interview is comprehensive and beyond the scope of the present paper. The precise practice is described in Høffding & Martiny 2016 and

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[4] For work on dance, improvisation and interactionism see Himberg et al 2018; Ravn 2016b.
[5] Another convincing "integrated" account of emotions is found in Michelle Maiese's work, overcoming the classical dichotomy contained in the question, "How can emotions be both cognitive and bodily" (Maiese 2014).

somewhat similar to Petitmengin et al's method (Petitmengin 2006; Petitmengin & Bitbol 2009), though closer to standard ethnographic work (Brinkman & Kvale 2014; Denzin et al. 2011) especially as seen in Ravn's work (Ravn 2016a; Ravn & Christensen 2014). The interviews fall within the ethnographic category of the "case study" (Flyvbjerg 2006; 2011), and because the DSQ have such an exceptional, expert skillset, the data moreover represents an "extreme" or "deviant" case ", which is "particularly well suited for theory development, because it helps researchers understand the limits of existing theories and to develop the new concepts, variables, and theories that will be able to account for what were previously considered outliers." (Flyvbjerg 2011, 307). In this case, a thorough analysis of the DSQ's different forms of musical communication and shared modes of intentionality can put pressure on the aforementioned expertise models.

The DSQ-members have several different ways of playing together that rely on different conscious and sub-conscious mechanisms. They have been described in Salice, Høffding & Gallagher 2017 as "motor resonance", "explicit coordination", and "interkinesthetic affectivity". To briefly summarize each of these mechanisms, motor resonance is conceived as a sub-conscious process which allows the DSQ members to trace each other, for instance through entrainment (Pacherie 2012). Such a sub-conscious process seems to be necessary to explain the instances of playing together in which the musicians are unaware – and sometimes totally oblivious – of each other, as for instance when engulfed in mind-wandering (Smallwood & Schooler 2006). Explicit coordination refers to a situation of uncertainty and lack of trust in themselves, each other or the performance situation as such, leading the DSQ members to forcefully impose a compensatory form of cohesion by trying to predict what the others' will do, by looking at each other and by giving visual cues. Interkinesthetic affectivity is a shared sense or feeling of moving together, availing detailed and intimately sensed knowledge of where the ensemble is heading musically speaking, which does not require prediction or mind-reading. In the following, we wish to focus on interkinesthetic affectivity because it is what according to the DSQ characterizes their optimal mode of playing together. Optimal insofar as it is the kind they enjoy the most and in which they report the highest degree of trust and intimacy, which is of relevance to our interactional agenda.

How can be best explain the interkinesthetic sort of interactions that DSQ members enjoy when they play together? What we are looking for within this kind of interaction are explanatorily powerful causalities. More precisely, we are not satisfied with a general account of how the DSQ-members agree to play together, *a la*, sharing the intention or commitment of playing together (cfr. Bratman 1992, Gilbert 2013). Rather, we want to be able to ascribe a kind of causal story at the micro level, pertaining to a single tone or melodic line as performed. A high-level, top-down story, would predict that they plan a precise interpretation of every single note that they stick to, using the score as a kind of memory cue. This would be supported also by the shared actions of making notations in the score during practice: once they find a suitable interpretation, they may mark it in the score to help remember a certain bowing, phrasing or fingering. The difficulty of playing a late Beethoven string quartets would be met not only with planning, but also with acts of prediction. Because they have played the pieces many times before, they have very precise predictions of the progress of the pieces, which translate into their motor-repertoire. In other words, predicting an upcoming difficult passage, they prepare certain hand-positions or thought patterns to smoothen the transition into such passages. In the midst of the concert,

however, with its rapid developments, constant adjustments, it might be objected that this kind of high-level, top-down thinking is just too slow and inflexible and that an embodied reflex-like mental pattern must be invoked in order to explain the unfolding of the concert. Rather than departing from various theories, let us look at the evidence from the interviews and then review how to best theorize about it.

The DSQ violist Asbjørn Nørgaard uses the metaphors of a "hive-mind" and a "bubble over everyone's heads" that he can somehow directly manipulate through his own actions. However, the hive-mind metaphor indicates that there is no single individual making the shots, but that it is an emergent and shared process

> It is just such a special feeling, if we perform a concert and there is a movement where it just clicks, because I've playing a lot of computer and sometimes demanded what I call "hive-mind"…where you have this feeling that I know, without knowing, I know what Frederik will do in 3 seconds and then I can do something that matches damn well, and then, I have also talked about as if it is a bubble.

> When you perform in the quartet, you know precisely when to play the tones, you know what the others are doing without looking at them. When everyone in the quartet is in this state, it is just like there is a bubble of sound over every ones' heads that you can just form as you wish.

When Asbjørn can "know what Frederik will do in three 3 seconds" this looks like a case of top-down prediction. However, Asbjørn importantly designates this kind of knowledge as a "feeling", or a knowing "without knowing". He is not predicting in the sense that he is making an inference from the current state of affairs. Rather, the future-directed feeling exists in the communicated bow-movements. He does not need to look at his co-players, as listening – and more importantly for our case, some form of music-mediated, bodily coupling – is more prevalent here. As sub-conscious, motor-resonance is involved in this regulation, but the causally efficient cognition here is the experienced feeling of trust that guides the unfolding. With regard to explicit coordination, this high-level kind of predictions are to be thought of as compensatory strategies that are rendered irrelevant once interkinesthetic affectivity is established. To Rune, the latter is experienced as a heightened and pervasive "trust". This feeling is expressive of the scaffolded cognitive resource of an intense intersubjective attunement, in which the co-players' movements and one's own appear on, or almost on, par: "I know what Frederik will do in three seconds" much in the same way as I know what I myself will do in three seconds.[6] Here is another example from Asbjørn about interkinesthetic affectivity and how it affects the non-individual determination of musical expression

> I can't say, now we should play faster, now we should do this or that. Then, perhaps I can get everyone to play faster, but then this bubble has collapsed. And then we're again four students of music playing in parallel lines. But this hive-mind… It is when that one is in place, it is very

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[6] This form of interkinesthesia has further implications for other debates in social ontology, e.g. what it means to be a 'we'. A detailed discussion of these intricate debates is beyond the scope of this paper, but see Satne 2019; Salice, Høffding and & Gallagher 2017.

difficult to affect very much through one's will power....I sounds contradictory, I can see that, but something is affected and some choices are made, but I just don't know where it comes from. When we perform these chorals and they change. It might be that it comes from me, but I have no clue. It emerges so instinctively. I think it is those instinctive things. You can clearly feel when you're playing, then I can feel when the others' *try* something. Or when it flows. You can feel when someone *believes* something or does something. "Now I *believe* it is too slow, so I'll get the tempo back up." That is a completely different feeling from that organic drive that does not derive from some concrete thought.

According to Asbjørn, as soon as someone is enforcing a pre-meditated interpretation, rather than maintaining this kind of bubble mentality, as soon as someone "tries something", or "believes something" this is detectable and degrades the community. Choices are made that drive the music forth, and which results in particular musical changes, for instance in the way they perform certain chorals of Danish composer Nielsen, slightly differently every time, but no individual is making these choices. And if they do, they become "students of music playing in parallel lines" that is, without cohesion, without actually playing *together*. Instead, the choices develop dynamically as the unfolding of one shared intention with which they all go along. Here is an ever-developing loop, in which the musicians begin playing, are drawn along by the music, leading them to engage the music differently, again changing the music and so on. Nevertheless, there is a sense that you can contribute to this interactive process, that you can help shape the bubble in a certain way, still on the premises of the interaction. This sense of musicality is not a reactive, pre-meditated stance. I am not obeying or even following the others. My agency is intact (or rather it is at the same time restricted by and expanded to the agency of the collective) and I chose to compliment and have mental freedom to enjoy a sense of how the music is about to unfold. Such mental processes are sophisticated, full of interpretations, choices, and preferences, but always on the premise of the artistic coherence of the music and collective. In other words, even if fast, and "instinctive" as Asbjørn says, the shared musical acts in interkinesthetic affectivity are not reflex-like, but intelligent, responsive, adaptive, and full of musical sense.[7] We will see the degree of intelligence and musical strategy even more clearly in the next case of free improvisation.

4) Case II: How do you play together – when alone?

One might at first hand think that the score-based, "classical" musician has a higher top-down load than the improvising jazz musician, as the former is restricted to a score and specific rules of interpretation, whereas the latter can be "spontaneous" and react on the spot. Nothing could be further from the truth. Torben Snekkestad, associate professor at the Rhythmic Music Conservatory, Copenhagen, is an expert jazz "free improvisation" saxophone player, with an extensive touring career and record portfolio.[8] He describes the importance of a well-developed practice of reflection on one's own technique and mind,

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[7] For more analysis of the role of bodily and affective intentionality in this kind of musical interaction, see Høffding 2019, chap. 11.

[8] See http://torbensnekkestad.com/ for more information. See also Snekkestad 2016.

as a necessity for producing interesting and original improvisations. Improvising with others is a "negotiation"

> In terms of sound it is merging in and out. Or perhaps do the opposite and be a contrast…how much is a dialogue, how much two monologues in parallel?...To what degree should it be independent in such a group? How much should you try to follow each other? To be drawn along, or argue back and forth, quarrel, caress each other

> For instance with a really good drummer, who can align himself very closely with you and then suddenly create a friction. Suddenly he can stop playing in the moment where it is most predictable that we're building to a climax, then he can just stop playing and in that way pull the rug from underneath your feet

The kind of free improvisation in which Torben specializes has neither score nor any explicit rules about what is to be played. He often has never before played together with a co-player for a particular concert, even if he might know them from recordings. This lack of shared knowledge and rules makes it challenging to perform something interesting, which to some extent changes the purpose of the music from being mostly about expressing a musical meaning or intention, to being primarily about exploring a certain form of interaction. Before beginning, he might have a certain technique he wants to explore and an idea about how he wants to interact with one or more co-players, but as soon as the music begins, all of that can immediately change based on what the others do. According to Torben, however, there is an implicit agreement among free improvisation players that it is about "pulling the rug" from underneath the others' feet, because this opens a new space of possibilities

> I believe that we try to create some obstructions exactly to lose control. Because as you lose control, then…it is experienced as a gift. Instead of becoming anxious and stumble, then something happens in that search, in that process of losing control, you experience it as a gift because "ok, now we have a totally new point of entry…ahh how exciting, let's engage"

This is a process of artistic research, in which each musician discovers news kinds of sounds, new forms or new techniques

> There is a possibility to work very intensively with some parameters of interaction together with others…which on the spot generates new ways of regarding yourself as a musician and of opening the material. You have a set of musical materials that you've worked on and you've been nerding with some textures. Now you throw it into a setting where it is lit up and where more layers of reflection are added. It is acted upon. Again, it is self-developing. At this point you develop your material. Not alone, but in a setting so you can return and see "ahh, ok, it [the material] was also capable of this."

According to Torben, free improvisation is not random spontaneity, it is not what he calls reflexive, but should be based on systematic practice and exploration, what he calls a "reflective practice". If merely reflexive, the music has no structure or intention and the musicians will often end up simply mimicking, call-responding, or what is known as "Mickey Mousing" the other. What he voices in the above

quotation, is that in order to build a good performance, one must possess a repertoire of extensively and systematically explored sounds and techniques, which one then brings to the performative table, where they in the best case can develop new dimensions.[9] The metaphor of "pulling the rug" indicates that free improv is inherently an interactive activity that constitutively relies on the other in order to unfold. In the "good" performance, the performers lift each other to new heights that could not be accomplished on one's own.

What makes Torben particularly interesting in this context, is his extensive practice with solo improvisation. For if you cannot get others to pull the rug from under your feet, how do you manage to do that yourself? In other words, is it possible to surprise oneself and thus go beyond one's own capacity, and if so what kind of techniques might allow for this? Torben has developed an extensive repertoire for this. As when playing with others, when alone he needs to "lose control", and he can do so on the saxophone by exploiting one of its non-ideomatic capacities, namely playing multiphonics also known as an "extended technique".

> I usually say that I am actually not playing solo, I am playing a duo. It is me and the sax and we sometimes work together and sometimes against each other.

Unlike a piano or a guitar, the sax is built to play one sound at the time, but the capacities of its construction can be transcended by certain very demanding finger- and embouchure-techniques through which rich series of under and overtones emerge. The multiphones require great strength and dexterity and are inherently unstable[10] and hence when playing them, one cannot predict exactly what sounds will emerge. Here lies a musical field ripe for exploration in which one can constantly negotiate the boundary between control and surprise with oneself. When an unexpected sound or expression emerges, one can then use that for improvisation and through a number of other physical and mental techniques distort and develop its expression. Examples of these techniques are letting the vibe of the audience, the room, and the texture of the reed influence one's play, using memory, imagination and different forms of listening to give color to one's tones, or of swaying one's temporal attention slightly backwards, to retain a better sense of where one is musically coming from, or slightly forwards, leaning into future possibilities. All of these techniques can also affect one another, sometimes almost independently of Torben's sense of agency, and constitute, together with the multiphonics, an entire agential system that can pull the rug from underneath Torben's feet. A proof of the artistically far-reaching consequences of such improvisatory explorations, is the fact that he re-invented an instrument, a "reed-trumpet"[11] as a response to his musical imagination and the interactive demands of his practice.

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[9] Importantly, it is not infrequent that these joint improvisations do not work out, that the collaboration does not function, or that the material developed is artistically and aesthetically uninteresting or senseless.

[10] The nature of the sax multiphonics can be affected by factors such as room temperature, the precise construction of the sax, and individual physiological differences of throat, jaw, and mouth.

[11] In the sixties, Eddie Harris also invented a reed-trumpet, but Torben's has an altogether different kind of mouth-piece.

This kind of activity cannot be planned. And again by planning, we are not referring to the general intention to perform, but to the performative microcosm of planning to play this or that tone. It is exactly in the transgression of intention and control that the improvisation can take off. Yet, it is also not reflexive or mono-causally input-output like. It is not merely spontaneous because it builds on a reflective, extensive practice and a sophisticated awareness of the roles and functions of this repertoire of physical and mental techniques employed in the service of pulling the rug from under one's own feet. Like for the DSQ, though even when on one's own, it is the premise of the interaction in the performative system that determines the precise production of this or that note or phrase.

5) Interaction as an overarching structure.

We have now demonstrated the role interaction plays in both joint and solo performance. From here, we turn to the analytic work of characterizing and analyzing the interactions that constitute skilled performance, vis-à-vis theories on expertise and joint action.

The first step in doing so is to explain exactly what it means for interaction to be a scaffolded cognitive resource. We refer to *scaffolding* here as a process through which cognition is sustained and actively transformed by extant external structures. This to side with "the scaffolded mind hypothesis" according to which "human cognitive capacities both depend on and have been transformed by environmental resources" (Sterelny 2010: 472). Following the central idea behind the claim that minds are scaffolded and in this sense, extensive, we hold that the limits of the mind are not the limits of the individual organism and may include part of the environment such as tools, materials and other agents, etc. (Clark & Chalmers 1998, Dreyfus 1972). In the case of expertise performance, this leads to our central claim regarding 'Arch', namely that we can understand musical expert performance as an overarching interactive structure that is transformed and sustained by an open-ended range of environmental resources including materials such as physical artifacts, e.g. sounds, written scripts and scores, as well as various bodies jointly attuned and the various resources they bring to the ongoing exchange. In this case, the scaffold is the music understood in its widest sense. This scaffold, analytically considered, changes the hybrid model we presented earlier from the car-like meta-system to the okapi-like homeostatic one. The musicians are usually not (besides for when the "system" breaks down and they have to rely on explicit coordination) in the business of switching between high-level inferential information-processing and low-level bodily and kinetic knowledge. Rather, while simultaneously employing several mental and bodily capacities, they participate in one integrated musical system that regulates the employment of these capacities, as when Torben switches improvisational techniques depending on his perception of the ambience in the room.

A second step is to understand what kind of joint action is involved in these cases. According to the standard way of thinking of joint action, there are two paradigmatic kinds of joint action. In one end, joint actions can be regulated by scripts, norms, rules, instructions, or plans that individuals know how to perform because they are highly trained in the practice they execute with others. - e.g. an orchestra playing a symphony, tennis-players dueling, institutional actions like large scale military invasions (Satne

2019, Pacherie 2012, Bratman 1992). In the other end, we have small scale actions executed with others that involve spontaneous coordination and online tracking of each others' contributions to the joint goal - e.g. improvised not expert joint dancing or playing catch (Satne & Salice 2019, Butterfill 2012; 2013; De Jaegher & Di Paolo 2007, Knoblich et al. 2011). Both of our cases cut across these distinctions. The DSQ's musical activity is regulated by a long normatively structured history of interaction, as based on scripts and instructions agreed upon during practice. Yet, at the same time, as when those chorals of Nielsen change from time to time, they are coordinating spontaneously not explicitly adhering to any of those scripts, plans or norms, but letting the music as it is currently and collectively experienced determine the path to take. On the surface, the DSQ seems mostly rule-following. A phenomenologically more justified description, however, is that their performance at the micro-level unfolds in the way it does due to all those rules and regulations working as scaffolds of the interaction. A good example hereof is when Frederik Øland reports hardly ever worrying about remembering how to play the pieces in the expansive repertoire: "once you start playing, it gives itself". Here again, knowledge and memory are scaffolded into the interaction and the performed music becomes a material repository of an extended, shared mind.

In contradistinction, for Torben, the interaction is premised on being unstructured and unplanned, as based on spontaneous coordination and tracking. Nevertheless, if he finds the music to be too random, or inversely, too structured and repetitive, he employs his repertoire of mental and physical techniques and takes personal hold of a new direction to push the music elsewhere. Again, on the surface level, there is spontaneous interaction. At the micro-level, however, this interaction, especially when not successful, is supported by a number of internalized scripts to which Torben has recourse. In addition to the layer of apparent interaction between the improvising musicians, a second layer of interaction exists between the unfolding music and Torben's internal repertoire, likewise guiding the performance. Moreover, in his solo-improvisation, this first layer of seemingly spontaneous interaction is unavailable and he has to produce it and enact it himself. In this case, he begins with the rehearsed and regulated techniques, but pushes them beyond his control such that they extend to take on the cognitive function of a kind of spontaneous interaction that in turn, scaffolds his new contributions to the improvised musical performance.

Thus, how should we characterize the rich interactions at stake in these cases of expert musical performance? We propose to think of them not with the model of joint action that emphasizes joint plans and common knowledge (Bratman 1992, Tomasello 2014) or joint commitments (Gilbert 2013). These theoretical models make resource to planning, mental theorizing and/or explicitly conveying ones will or intentions to perform certain actions of the kind we saw in the examples of expert musicianship that are not always present in joint musical performance, and when they are, sometimes hinder the quality of the joint performance. Remember how Asbjørn regards the explicit "thinking something" or wishing to express something willfully, degrades the DSQ community to one of musical students playing in parallel. To the DSQ, willful expression and explicit coordination results from musical failure or insecurity and prevents the natural musical flow that runs best through process of interkinesthetic affectivity. These theoretical models of joint action seem to commit one to overly intellectualized

accounts of the cognitive mechanisms involved in joint activity and underscore only some aspect of the rich, multivaried and multimodal interactions described above (Satne 2019; Zahavi & Satne 2015).

We are also not convinced that the model of minimal coordination proposed by Butterfill and others (Butterfill 2012; 2013; Butterfill & Sinigaglia 2014; Knoblich, et al. 2011), can do justice to the integration of low-level and high-level cognitive mechanisms involved. The 'minimalist program' (Knoblich et al. 2011, Butterfill 2012, Butterfill & Sinigaglia 2014) pursues a non-cognitively-demanding conception of joint action that can serve as a platform for the development and evolution of sophisticated human cognitive capacities (cf. Butterfill 2012).The view proposes to model basic joint activities as an overlap of individual goals pursued by the participant agents. While this can be useful for understanding certain aspects of joint musical performance, it seems too minimal to be suited to address the complex integrated capacities, skills and strategies both solo and joint that musicians report to use when playing together.

As mentioned in the outset of the paper, the focus on minimal coordination is shared with the 'sense-making paradigm' (De Jaegher & Di Paolo 2007; De Jaegher, Di Paolo and Gallagher 2010). As the following example shows, neither of them can easily be made to accommodate our phenomenological reports describing joint and solo expert musical performance. They may both be compatible with the DSQ experience of interkinesthetic affectivity, where the members' communication is constituted by an affective, bodily and kinesthetic sense, a kind of joint body-schema (Soliman & Glenberg 2014). The DSQ, however, also employs more sophisticated, meta level, communicative strategies that we have not referred to in this paper (for an expanded description see Høffding 2019, chap. 11)- which in Torben's case is even more clear. How does the sense-making paradigm scale up to the kind of situation, in which Torben judges that the interaction is too stale and decides to throw some gravel in the machinery? Imagine a case where he looks for a way to 'pull the rug' from the pianists feet, deciding to make a surprising shift in tonality and tempo, with a musical reference to Charlie Parker, mixed with a multiphonic, played in that particular way that reminds him of his childhood diving in the Norwegian archipelago, while simultaneously musically commenting on the guy in the audience who just dropped his beer. Here is a single musical action that in one sweep executes mental functions of coy pretense (pulling the rug), normative reference (Charlie Parker), episodic memory (childhood diving), imagination (the sense of being submerged in water), planning (deciding how to go into the multiphone) as well as a humorous grasp of and response to a social situation (spilling the beer).

The challenge to the sense-making paradigm also obtains in the expertise debate. How would the mindlessness or automaticity accounts explain the presence of all these heavy cognitive actions? And inversely, how would the "cognition-in-action" paradigm do it, all the while also covering the DSQ cases of interkinesthetic affectivity?

'Arch' proposes to describe the musical interactions mentioned as cases of joint activity led by the musicians' shared embodied, situational and sometimes even intellectual, understanding of why and how to do what they are doing. We further claim that from minimal to complex, this shared understanding can be based on different psychological mechanisms, including bodily coordination, attunement to others' feelings and emotions, knowledge of shared norms and instructions, and sharing

reasons on why and how to act, which can be combined in various ways in the unfolding of these activities. According to this conception, joint intentional activities are distinguished from a mere aggregation of individual acts by an overarching normative structure of appropriately related individual participations that has normative significance for the way in which each participant carries out her actions. Individuals are conjoined in an intentional action of this kind when they share an understanding of the activity they perform together. This means that they have shared practical understanding of the purpose of their actions and the means to attain the goal together. This understanding can be obtained in online interactions, can be inherited form previous interactions, or can be scaffolded by shared norms, scripts and scores, and other environmental materials and tools, or all of these together and combined in various ways. Here again, by "understanding" we mean an embodied, as well as situated understanding, that many times is also intellectually informed. The subject of these intentional activities is not an individual that coordinates with others, but rather a plural subject, a we, a "hive-mind", that subsumes the different individuals involved in the action as well as the agential pull of the music as performed that scaffolds the activities of the group.

Shared intentionality so understood is associated with a minimal understanding of others' mentality and agency. What is characteristic of these forms of interaction is that each participant's role in the activity is determined and structured by the shared activity in which they are taking part, without the participants necessarily planning ahead or intellectually predicting and representing the mental states of their partners. Nevertheless, this activity is also scaffolded by shared cultural norms and past practices, and by the exercise of guided and individual practical reasoning, that together make it possible for more sophisticated reason-guided and complex skilful collective behaviour to emerge and be sustained. The individuals in the cases under analysis move back and forth within this overall structure of joint activity, relying on different mechanisms, intellectual, situationally and embodied, some of which are extended and environmental, to create more complex and interesting forms of engagement and musical performance.

'Mesh' as a hybrid has done a good job demonstrating some of the exact ways in which the embodied low-level cognitions match up with the high-level sophisticated ones. In this paper, we do not yet aspire to the same level of explanatory detail. Instead we propose that the notion of interaction presented at the core of 'Arch', on the one hand, can begin to compensate for too one sided approaches to both expertise and joint action that emphasise alternatively low-level or high-level cognitive mechanisms, and on the other hand, can complement and expand the interaction-based accounts and the intermediate Mesh strategy. The intermediate account, if indeed Mesh is such an account, might seem like a tempting option, but it carries with it the problem of how to connects the relata of the high-level and the low-level. The account of interactive expertise proposed here, endorsing Mesh's anti-individualist and anti-internalist tenets, provides a multi-layered approach to solo and joint activity in expert musical performance that provides the right starting point to device how the connection or interface problem could be overcome. 'Arch' claims that cognitive processes both high and low, are integrated from the outset in an over-arching system that is given and sustained by an ongoing interaction between agents and environmental structures entrenched in it. The shift from the hybrid car model to the okapi model explained above can help clarify why 'Arch' does not face an interface problem in the way as both

'Mesh' and Fridland's proposals do. As we explained above, while the 'hybrid car' model relies on two separate systems, the electric and the gasoline system, and it can be thought to be integrated insofar as it uses these two systems alternately to effectuate locomotion, the okapi is not made up of one giraffe-part and one zebra-part. The okapi is integrated in the homeostatic sense of being a singular phenomenon that embeds other phenomena into a new structure that is not one nor the other, not the mere summation or alternation of the two. We propose to think of interaction as such an overarching structure constituted by the interplay between high and low level cognitive resources, internal and external elements, as well as both individual and collective states and interwoven participations.

While a detailed analytical treatment of the interface problem exceeds the ambitions of this paper, the case made here is sufficient for providing an overlook of how 'Arch' by emphasising the role of interaction as an overarching structure, proposes to address the question of how intermediate levels of cognition do interface between brute bodily and sophisticated propositional cognitive processes. According to 'Arch' these different cognitive processes are distributed in external scaffolds and integrated through the interactive activity of collective agents. Musical materials such as instruments, sounds and scores as well as other players can constitute agentive poles in which different parts and aspects of the cognitive processes are distributed. All of this constitutes an overarching structure, which is not only exhibited in cases of group performance like that of the DSQ, but also in solo improvisation when individuals exploit it to create innovative ways of performing.

Acknowledgements

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