JazzFlow – Analyzing "Group Flow" among Jazz Musicians Through "Honest Signals"

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Abstract. In this project we aim to analyze "honest signals" between Jazz musicians by using sociometric badges with the goal of identifying some of the pre-requisites for "flow", the state of work where "time flies", and the worker is at his most-productive best. We extend the concept of individual "flow" as defined by Csikszentmihalyi (1990) to the group level, trying to identify some of the conditions indicative of the group flow state. We speculate that a band of Jazz musicians is particularly well suited to study group flow, because they collaborate as a self-organizing team, involved in highly creatively work while passing leadership of the tune for the solo part from one band member to the next.

Introduction

Imagine listening to a live jazz concert. The lead singer is warming up the audience, then the saxophonist, the trumpet player, and the baritone sax pick up the tune from the lead singer, and the music starts in earnest. After a first full combo, where all members of the orchestra take an active part, the tune is passed on to the baritone sax, with support from the drummer and the base, the other orchestra members relax, smiling and supporting the baritone sax by whipping their bodies in synch with the tune. Then, the baritone sax finishes his solo, and passes the lead back to the orchestra, which takes over again as a team. This repeats to the trumpet and the drums, then the tune is passed on to the singer; the two sax players and the trumped player are now so in swing, they start a wild dance, rhythmically kicking their heels and hopping around to the tune played by base, guitar, keyboard, and singer. Finally the entire orchestra engages into a furious finale, all band members playing together as one unified whole. This or a similar scenario takes place every time a jazz band plays together.

For us, a Jazz band is an ideal blueprint of a self-organizing team, working together in a state of flow, as defined by Csikszentmihalyi (1990). In this project we aim to analyze "honest signals" between Jazz musicians by using sociometric badges (Olguin 2007) with the goal of identifying some of the pre-requisites for "flow", the state of work where "time flies", and the worker is at his most-productive best.

Related Work

The interactional perspective on creativity suggests that the effective translation of ideas into action will depend on a variety of individual and situational attributes such as motivation, skills, personality, and contextual features (Zhou et al., 2009; Woodman et al., 1993). Individual cognitive biases may constrain creativity. Because creativity in the organizational context involves the recombination of different existing ideas, researchers are looking for social sources of new ideas going beyond individual cognitive processes (Sawyer, 2009). Very little work has been done looking at flow as a potential cause of creativity and its occurrence among musicians. The only research we know of is from (Manzano et. al. 2010), who looked at

the flow experience of individual pianists. 21 professional classical pianists were asked to manually classify their flow experience while playing the piano. It was found that heart rate, blood pressure, and respiratory breadth of the pianists predicted their flow experiences. In our work, we are extending this research in two ways, to measuring other human body signals, and broadening it from the individual to the group.

Our study relies on work done by Sandy Pentland (2008) and his team at the MIT Media Lab on identifying "honest signals". These signals are an important component of individual behavior, as they are unconscious signs that individuals exhibit during social interactions. Pentland measured these honest signals by analyzing body movement patterns, and the timing, energy, and variability of speech. Based on experimental data collected within a German bank, a large hospital in the Boston area and a bank in the Czech Republic, Olguín-Olguín and Pentland (2010) found that social signaling behavior and face-to-face network characteristics can predict group performance.

When measuring creativity, many researchers mix up performance and creativity, assuming that a high-performing group or individual must be more creative (Hackman and Katz, 2010). In this project however we have the advantage that the performance of the team indeed depends on the creativity of the team members. By measuring satisfaction of the audience through the strength of the applause we obtain a direct metric for the quality of the output of the creative team.

While it has been commonly assumed that extroverted leaders are more successful, (Grant et al. 2011) recently paint a more differentiated picture. They find that for teams with more active members, a more introverted leader, who delegates responsibility to a self-organizing team, will achieve better results. We therefore expect to find a similar pattern for a team of jazz musicians, where there is little space for the primadonna type musician, rather band members take turns in assuming the leadership role during their solo plays.

Method

During a Jazz concert we equipped a professional Jazz band with sociometric badges (figure 1), which collect energy levels of the wearer through a built-in accelerometer as well as the pitch of the sound with a microphone. The badges also measure absolute position, and when the wearers are facing each other through IR and radio sensors. We did not use this feature, however, because band members are not facing each other while they play, but coordinate through listening to each other's music while facing the audience.

Figure 1. Sociometric badge

Normally these badges are worn around the neck, but in the case of the Jazz musicians, this would have been too intrusive and interfere with them playing their instruments, so they just placed them in their shirt or pant pockets, which was sufficient to collect the accelerometer and microphone data. Unfortunately we

had to discard some data, because the badges did not record it correctly, this way we lost the sociometric data of the tenor sax and the base player.

Results

In our experiment the band consisted of eight musicians (the singer who was the band leader, tenor sax, baritone sax, trumpet, guitar, keyboard, base, and drums). In addition one member of the audience was wearing a further badge to control for sound- and energy levels in the audience in contrast to the band.

Figure 2. Narrative of one Jazz piece

Figure 2 displays four phases during one piece of music, starting with the warm-up of the singer, the solo of the sax player, the excited dance of the brass players in synch with the guitar, bass and drums, and the finale of all members of the orchestra.

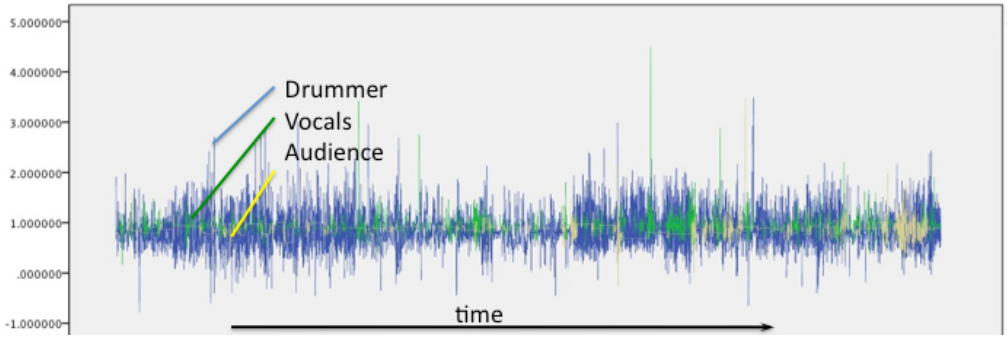

Figure 3. changes in energy over time of drummer (blue), lead singer (green) and audience (yellow)

Figure 3 illustrates changes in energy levels over the entire two-hours of the concert. The blue line (the drummer) oscillates the most, while the singer and bandleader, as well as the one person representing the audience have much lower oscillations. The intermissions, after each piece, are clearly recognizable. We

noticed strong negative correlation between average energy level and standard deviation of energy among band members (figure 4) (r=-0.862*, n=6). This means that the musicians with the lowest fluctuations in energy levels were playing with continuously high energy, while the players with low mean energy were showing strong bursts of energy. When looking at individual players, we found that the drummer and trumpet players had the lowest mean energy levels (0.86 and 0.85 respectively) with comparatively high standard deviation of 0.4, while the keyboard and guitar players had much higher mean energy of 1.0 and 1.1, with comparatively low standard deviation of 0.2.

We wonder if this is dependent on personal style of the musician, or if it has to do with the instruments: playing the drums and the trumpet is a high-energy activity, which is sustainable only if there are low-energy phases, although minuscule, to recover and relax. Playing the keyboard and the guitar, on the other hand, seems to be less physical work, which allows the musicians to remain on continuously high energy levels. Another explanation might be that keyboard and guitar in this band have the responsibility for the groove of the music (speed and rhythm for example).

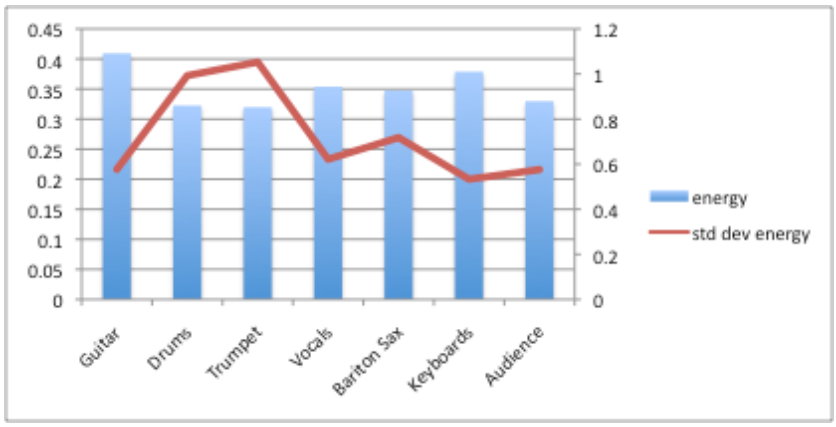

Figure 4. Mean Energy and Standard deviation of musicians and audience.

Comparing the energy levels collected by the accelerometer showed a separation into small groups. The correlations (table 1), comparing the accelerometer readings sampled once per second over the duration of the entire concert, were rather weak however. We nevertheless think that the groupings of who is in synch with whom are rather interesting. The drummer is positively correlated with the trumpet player (0.062**) – also sharing a similar energy profile of comparatively low energy with high standard deviations – while being negatively correlated with the keyboard player (-0.038**). The guitar player is negatively correlated with the singer, who is also the bandleader (-0.026*). The trumpet player, besides being correlated with the drummer, is also correlated with the baritone sax player (0.107**), and negatively correlated with the keyboard player (-0.035**). The bandleader and singer is positively correlated with the baritone sax (0.051**), and negatively correlated with the one member of the audience wearing a badge (-0.027*). The keyboard player seems to be of a rather independent mind, as he is negatively correlated both with the drummer, and the trumpet player, while having positive correlation with the baritone sax (0.028*). The only correlation the member of the audience has is the weak negative correlation with the bandleader.

		guitar	trumpet	vocals	baritone sax	keyboard	audience
drums	Pearson Correlation	.006	.062**	-.006	.022	-.038**	.004
	Sig. (2-tailed)	.659	.000	.634	.099	.004	.740
	N	5805	5805	5805	5805	5805	5805
guitar	Pearson Correlation		.011	-.026*	-.002	-.008	.023
	Sig. (2-tailed)		.382	.046	.865	.546	.077
	N		5805	5805	5805	5805	5805
trumpet	Pearson Correlation			-.006	.107**	-.035**	-.007
	Sig. (2-tailed)			.667	.000	.008	.618
	N			5805	5805	5805	5805
vocals	Pearson Correlation				.051**	.015	-.027*
	Sig. (2-tailed)				.000	.249	.042
	N				5805	5805	5805
baritone sax	Pearson Correlation					.028*	.021
	Sig. (2-tailed)					.030	.118
	N					5805	5805
keyboard	Pearson Correlation						.018
	Sig. (2-tailed)						.173
	N						5805

Table 1. Correlations in energy between the different musicians and the audience

This individual analysis seems to indicate a grouping of the band into three fractions, the drummer-trumpet-baritone sax-keyboard group, and two musicians being each a group of their own, the singer and bandleader, and the guitar player (figure 5). The baritone sax player seems to have a role as a bridge, connecting the drummer-trumpet group, and the otherwise isolated bandleader. Figure 5 also confirms – as is commonly the case with Jazz orchestras – the central role of the brass instruments, with trumpet, and even more so the baritone sax being the connectors of the other instruments. The keyboard player and the singer seem to be quite provocative, both being negatively correlated twice with other members of the band or the audience. The guitar player seems only positively linked to the audience.

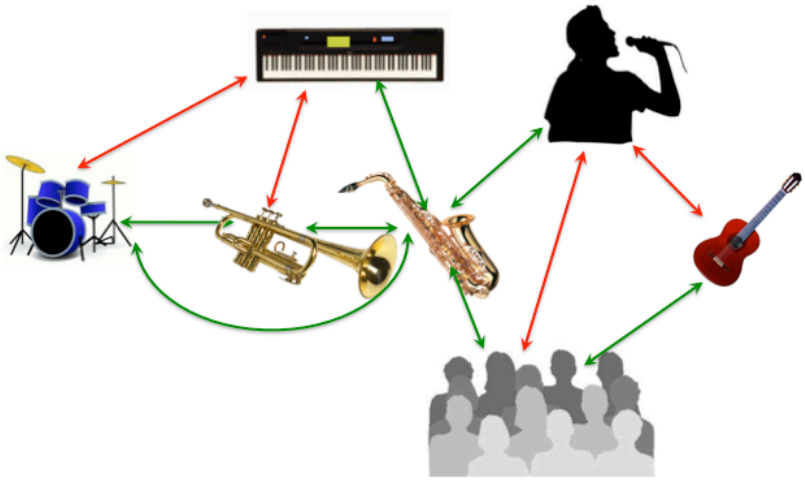

Figure 5. Social Interaction Chart of band members (green arrows are positive correlations, red arrows are negative correlations).

While this analysis was done over the entire duration of the concert, next steps will be to compare the intensity of applause after each piece of music with the level of correlation in energy between the musicians while playing the particular tune. We speculate that the more the band gets into synch, i.e. the more it is in group flow, the more the audience will also be touched and get carried away by the tune. While this is a very early experiment, it opens up radically new ways to studying group dynamics among self-organizing teams reaching the flow state.

Conclusions

We are convinced that we are only at the beginning of a new era of research, trying to better understand what drives team creativity by analyzing "honest signals" of team members. While our results are preliminary, they are extremely promising, as they seem to suggest that getting into synchronized swing is essential for successful collaboration. Understanding "honest signals" is one way of identifying collaborative communicators such as the saxophone player, who are essential "glue" to enable the smooth operation of a creative team such as a jazz orchestra.

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