

Musical Synchronization and the Secrets of Swing

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It is a widespread opinion that musicians who are interacting together in a performance should perfectly synchronize their timing. This view was challenged for the swing feel, a salient feature of jazz, which has eluded scientific clarification for a century. For much of this period it was considered arcane, arguing that swing can be felt but not explained, until a theory of ‘participatory discrepancies’ raised the controversial claim that swing is caused by microtiming deviations between different participating musicians [1] and put a question mark on the synchronization of jazz musicians.

In several projects we have clarified the controversy on the central role of microtiming deviations for the swing feel using data analytics [2] and experiments [3,4] in which we manipulated the timing of different instruments and measured the resulting swing feel through ratings of professional jazz musicians. We thereby showed that involuntary random microtiming deviations are irrelevant for swing [3], but found that a particular systematic microtiming deviation between musicians enhances the swing feel and is a key component of swing in jazz [4]. It consists in phase shifts, where downbeats of soloists are slightly delayed with respect to a rhythm section, but offbeats remain strictly in phase.

This effect was unknown to professional jazz musicians, who were able to perceive the differences, but unable to determine their nature. Thus musicians apparently use the effect intuitively and unconsciously, as our data analysis of 456 renowned jazz solos revealed the use of downbeat delays in almost all cases [4].

[1] C. Keil, *Cultural Anthropology* 2, 275 (1987)

[2] M. Sogorski, T. Geisel, and V. Priesemann, *PLoS One* 13(1), e0186361 (2018)

[3] G. Datsoris, A. Ziereis, T. Albrecht, Y. Hagmayer, V. Priesemann, and T. Geisel, *Sci. Rep.* 9, 19824 (2019)

[4] C. Nelias, E.M. Sturm, T. Albrecht, Y. Hagmayer, and T. Geisel, *Commun. Phys.* 5, 237 (2022)