

Itamar

REVISTA DE INVESTIGACIÓN MUSICAL: TERRITORIOS PARA EL ARTE



AÑO 2021

7

 Facultat de Filosofia i Ciències de l'Educació



VNIVERSITAT
DE VALÈNCIA

Itamar

REVISTA DE INVESTIGACIÓN MUSICAL: TERRITORIOS PARA EL ARTE

REVISTA INTERNACIONAL

N. 7

AÑO 2021



VNIVERSITAT
ID VALÈNCIA

 Facultat de Filosofia i Ciències de l'Educació

Edición electrónica

© *Copyright 2018 by Itamar*

Dirección Web: <https://ojs.uv.es/index.php/ITAMAR/index>

© *Edición autorizada para todos los países a:*
Facultad de Filosofía y Ciencias de la Educación. Universitat de València

I.S.S.N: 2386-8260

Depósito Legal: V-4786-2008

EQUIPO EDITORIAL

PRESIDENCIA DE HONOR

Edgar Morin. Presidente de Honor del CNRS, París. Presidente de la APC/MCX Association pour la Pensée Complexe y del Instituto Internacional del Pensamiento Complejo.

DIRECCIÓN

Jesús Alcolea Banegas
Vicente Manuel Claramonte Sanz
Rosa Iniesta Masmano
Rosa M^a Rodríguez Hernández

COMITÉ DE REDACCIÓN

Jesús Alcolea Banegas
José Manuel Barrueco Cruz
Vicente Manuel Claramonte Sanz
Rosa Iniesta Masmano
Rosa M^a Rodríguez Hernández

COMITÉ CIENTÍFICO

Rosario Álvarez. Musicóloga. Catedrática de Musicología. Universidad de La Laguna, Tenerife, España.

Alfredo Aracil. Compositor. Universidad Autónoma de Madrid, España.

Leticia Armijo. Compositora. Musicóloga. Gestora cultural. Directora General del Colectivo de Mujeres en la Música A.C. y Coordinadora Internacional de Mujeres en el Arte, ComuArte, México.

Javiera Paz Bobadilla Palacios. Cantautora. Profesora Universidad de Artes, Ciencias y Comunicación UNIACC, Chile.

Xoan Manuel Carreira. Musicólogo y periodista cultural. Editor y fundador del diario www.mundoclasico.com (1999-...), España.

Pierre Albert Castanet. Compositeur. Musicologue. Université de Rouen. Professeur au Conservatoire National Supérieur de Musique de Paris, France.

Giusy Caruso. Pianista. Musicologa. Ricercatrice in IPEM (Istituto di Psicoacustica e Musica Elettronica) Dipartimento di Musicologia, Università di Ghent, Belgio.

Olga Celda Real. Investigadora Teatral. Dramaturga. King's College London. University of London, Reino Unido.

Manuela Cortés García. Musicóloga. Arabista. Universidad de Granada, España.

Nicolas Darbon. Maître de conférences HDR en Musicologie, Faculté des Arts, Langues, Lettres, Sciences Humaines. Aix-Marseille Université. Président de Millénaire III éditions. APC/MCX Association pour la Pensée Complexe, France.

Cristobal De Ferrari. Director Escuela de Música y Sonido Universidad de Artes, Ciencias y Comunicación UNIACC, Chile.

Román de la Calle. Filósofo. Departamento de Filosofía, de la Facultad de Filosofía y Ciencias de la Educación de la Universitat de València, España.

Christine Esclapez. Professeure des universités - Membre nommée CNU 18e section - UMR 7061 PRISM (Perception Représentation Image Son Musique) / Responsable de l'axe 2 (Créations, explorations et pratiques artistiques) - Responsable du parcours Musicologie et Création du Master Acoustique et Musicologie - Membre du Comité de la recherche UFR ALLSH - POLE LETTRES ET ARTS. Aix-Marseille Université, France.

Reynaldo Fernández Manzano. Musicólogo. Centro de Documentación Musical de Andalucía, Granada, España.

Antonio Gallego. Musicólogo. Escritor. Crítico Musical. Real Academia de Bellas Artes de San Fernando, Madrid, España.

Loenella Grasso Caprioli. Presidentessa di RAMI (Associazione per la Ricerca Artistica Musicale in Italia). Professoressa presso il Conservatorio di Brescia.

Anna Maria Ioannoni Fiore. Musicologa. Pianista. Vicepresidentessa di RAMI (Associazione per la Ricerca Artistica Musicale in Italia). Professoressa presso il Conservatorio di Pescara, Italia.

Adina Izarra. Compositora. Escuela de Artes Sonoras, Universidad de las Artes. Guayaquil, Ecuador.

Pilar Jurado. Cantante. Compositora. Productora. Directora artística y ejecutiva de MadWomenFest. Presidenta de la SGAE, España.

Jean-Louis Le Moigne. Chercheur au CNRS, Paris. Vice-président d'APC/MCX Association pour la Pensée Complexe, France.

María del Coral Morales-Villar. Departamento de Didáctica de la Expresión Musical, Plástica y Corporal. Universidad de Granada, España.

Yván Nommick. Pianista. Director de Orquesta. Compositor. Musicólogo. Catedrático de Musicología de la Universidad de Montpellier 3, Francia.

Juan Bernardo Pineda. Coreógrafo, bailarín y artista plástico. Profesor titular de Performance y Lenguaje audiovisual en la Universidad de Zaragoza, España. Profesor invitado en la Kocaeli Universitesi y Sakarya, Universidad de Turquía. Miembro del International Dance Council, UNESCO.

Carmen Cecilia Piñero Gil. Musicóloga. IUEM/UAM. ComuArte. Murmullo de Sirenas. Arte de mujeres, España.

Antoni Pizà. Director Foundation for Iberian Music. The Graduate Center, The City University of New York, Estados Unidos.

Rubén Riera. Guitarrista. Docente titular. Escuela de Artes Sonoras, Universidad de las Artes. Guayaquil, Ecuador.

Dolores Flovia Rodríguez Cordero. Profesora Titular Consultante de Didáctica aplicada a la Música. Departamento de Pedagogía-Psicología. Universidad de las Artes, ISA, La Habana, Cuba.

Leonardo Rodríguez Zoya. Director Ejecutivo de la Comunidad de Pensamiento Complejo (CPC). Investigador Asistente en el Consejo Nacional de Investigaciones Científicas y Técnicas (Argentina). Instituto de Investigaciones Gino Germani, de la Universidad de Buenos Aires. Profesor Asistente en Metodología de la Investigación, en la Universidad de Buenos Aires. Coordinador del Grupo de Estudios Interdisciplinarios sobre Complejidad y Ciencias Sociales (GEICCS), Argentina.

Pepe Romero. Artista Plástico. Performer. Universidad Politécnica de Valencia, España.

Ramón Sánchez Ochoa. Musicólogo. Catedrático de Historia de la Música, España.

Cristina Sobrino Ducay. Gestora Cultural. Presidenta de la Sociedad Filarmónica de Zaragoza, España.

José M^a Sánchez-Verdú. Compositor. Director de Orquesta. Pedagogo. Profesor en el Real Conservatorio Superior de Música de Madrid, España. Profesor de Composición en la Robert-Schumann-Hochschule de Dusseldorf. Sus obras se editan en la editorial Breitkopf & Härtel.

José Luis Solana. Antropólogo Social. Universidad de Jaén. Universidad Multiversidad Mundo Real Edgar Morin. APC/MCX Association pour la Pensé Complexe, España.

Álvaro Zaldívar Gracia. Musicólogo. Catedrático de Historia de la Música. Director del gabinete técnico de la Subsecretaría del Ministerio de Educación. Académico de Número de la Real Academia de Bellas Artes de Murcia y Miembro correspondiente de las Reales Academias de Bellas Artes de Madrid, Zaragoza y Extremadura, España.

Portada: *Levedad*, Bocetos de Mujer
Daniela Hlavsova y Tony Montesinos, bailarines
Juan Bernardo Pineda, coreografía, edición y realización
José María Hortelano, operador de cámara

ITAMAR cuenta con los siguientes apoyos institucionales:

Universidad de Jaén, España



UNIVERSIDAD DE JAÉN

Universidad de Buenos Aires, Argentina



Université de Rouen (Francia)



Aix-Marseille Université, Francia



Conservatorio Nacional Superior de París,
Francia

**CONSERVATOIRE
NATIONAL SUPÉRIEUR
DE MUSIQUE ET
DE DANSE DE PARIS**

CIDMUC, La Habana, Cuba



Comunidad Editora Latinoamericana,
Argentina



Consejo Nacional de Investigaciones
Científicas y Técnicas (CONICET) de
Argentina



Universidad de Artes, Ciencias y
Comunicación, Chile



Comunidad Internacional de
Pensamiento Complejo, Argentina



APC/MCX Association pour la Pensé Complexe, Paris



Colectivo de Mujeres en la Música.
Coordinadora Internacional de
Mujeres en el Arte, ComuArte

MadWomanFest



RAMI - associazione per la Ricerca
Artistica Musicale in Italia

Universidad de Zaragoza



Departamento de
Expresión Musical,
Plástica y Corporal
Universidad Zaragoza

King's College London,
United Kingdom

Universidad de las Artes de
Guayaquil, Ecuador



Université des Antilles, Guyane



ITAMAR. REVISTA DE INVESTIGACIÓN MUSICAL: TERRITORIOS PARA EL ARTE
Nº 7, Año 2021 I.S.S.N.: 2386-8260
Facultad de Filosofía y Ciencias de la Educación. Universitat de València (España)

Artículos de investigación

The Effect of Music on Movement Perception: Synchresis in Hits for HIIT

Sophie Stévançe
Serge Lacasse
Université Laval, Quebec City, Canada

Abstract. Hits for HIIT consists in a research-creation project aiming to produce both musical pieces and training exercises for, on the one hand, optimizing HIIT practice and, on the other, enriching scholarly research on the relations between music and sports. These questions and their related studies have highlighted music/movement relations and the way they are *perceived*. In this paper we would like to outline how we attempt to build a two-way dialogue between the production of music adapted to HIIT and the design of workouts based on the music.

Keywords. Creation music and sports, synchresis, research-creation, high intensity interval training, music parameters.

Resumen. Hits for HIIT consiste en un proyecto de investigación-creación con el objetivo de producir tanto piezas musicales como ejercicios de entrenamiento para, por un lado, optimizar la práctica del HIIT y, por otro, enriquecer la investigación académica sobre las relaciones entre música y deporte. Estas preguntas y sus estudios relacionados han resaltado las relaciones música / movimiento y la forma en que son *percibidos*. En este artículo nos gustaría esbozar cómo intentamos construir un diálogo bidireccional entre la producción de música adaptada al HIIT y el diseño de entrenamientos basados en la música.

Palabras clave. Creación musical y deportiva, sinchresis, investigación-creación, entrenamiento a intervalos de alta intensidad, parámetros musicales.

Context

“Hits for HIIT” is an innovative project through which we wish, as music researchers-creators and athletes, to offer music specifically designed for High Intensity Interval Training (commonly called HIIT)¹. Music is indeed very

important in this kind of training: Among the studies attempting to identify factors increasing the benefits of training, the vast majority have shown that HIIT enthusiasts were performing better when listening to instrumental or vocal music² notably because music tends to generate positive emotions³. So far, relations between music and sport has primarily been studied in the field of sport psychology⁴. These studies have shown that listening to music during workout increases positive affect, decreases the perceived effort, postpones fatigue, improves motivation, maintains maximum cardiac rhythm, and fosters higher productivity.

In order to better understand how music supports exercise in a psychological perspective, kinesiologists have identified musical characteristics such as rhythm, melody, as well as some extra-musical features (what music evokes⁵) without, however, taking into account other important parameters that would require musicological scrutiny: harmony, instrumental and vocal performance, as well as technological parameters responsible for our perception of recorded space (e.g., reverberation), time (e.g., delay), dynamics (e.g., sound level) and timbre⁶. At the moment, music used by people performing HIITS is mostly selected according to one's current emotional state and was thus not designed to provide a logical and evolutive guidance through the different HIIT phases. We are hoping that Hits for HIIT will contribute to filling that gap.

* Fecha de recepción: 09-12-2020/ Fecha de aceptación: 8-1-2021.

¹ HIIT consists in the combination of exercises of moderate and maximum intensity interspersed with periods of rest (Borrelli 2015). Interval training can *a priori* be applied to many activities, such as running (sprinting), cycling (spinning) or swimming. In this study, we will be focusing on HIIT practiced in the form of a sequence of several different exercises performed at bodyweight in order to solicit a maximum of muscle groups (COMANA, 2018).

²SANCHEZ, Xavier, MOSS, Samantha L., KARAGEORGHIS, Costas I. et TWIST, Craig: "On the Role of Lyrics in the Music-Exercise Performance Relationship", in *Psychology of Sport & Exercise*, Volume 15, Issue 1, January 2014, pp. 132-138; SLOBODA, John: « The ear of the beholder », in *Nature*, 454 (7200), 2013.

³ KARAGEORGHIS 2017; PETRI, Laukka et QUICK, Lina. 2011. "Emotional and motivational uses of music in sports and exercise: A questionnaire study among athletes", in *Psychology of Music* 41(2), 2011, pp. 198–215. <https://doi.org/10.1177/0305735611422507>

⁴ Notably TERRY, Peter C. et KARAGEORGHIS, Costas I.: « Music in sport and exercise », in *The new sport and exercise psychology companion*. Sous la direction de Tony Morris et Peter. C Terry Morgantown, WV: Fitness Information Technology, 2011, pp. 359–380; STORK, Matthew; KWAN, YW; GIBALA, Martin J. et MARTIN GINIS, Kathleen. A: "Music enhances performance and perceived enjoyment of sprint interval exercise", in *Medicine and Science in Sports and Exercise* 47 (5), 2015, pp. 1052-1060.

⁵ KARAGEORGHIS, COSTAS, LANE, TERRY: "Development and initial validation of an instrument to assess the motivational qualities of music in exercise and sport: The Brunel Music Rating Inventory", in *Journal of Sports Sciences* 17 (9), 1999, pp. 713-724.

⁶ E.G., timbre modification such as heavy distortion: LACASSE, Serge: « Slave to the Supradiegetic Rhythm: A Micro-Rhythmic Analysis of Creaky Voice in Sia's "Breath Me" », in *Musical Rhythm in the Age of Digital Reproduction*, sous la direction d'Anne Danielsen, Ashgate, Aldershot, 2010, pp. 141-155, pp. 152-155).

Hits for HIIT consists in a research-creation project aiming to produce both musical pieces and training exercises for, on the one hand, optimizing HIIT practice and, on the other, enriching scholarly research on the relations between music and sports. Accordingly, during the first phase of the project we wanted to better understand: 1) the kind of music used during HIIT practice; 2) what participants liked about this music; 3) how this music is structured (from a musicological perspective); and 4) the extent to which this music is adapted or not to HIIT training as we understand it in the context of this study (a sequence made of many bodyweight exercises).

So far, these questions and their related studies have highlighted music/movement relations and the way they are perceived. In this paper we would like to outline how we attempt to build a two-way dialogue between the production of music adapted to HIIT and the design of workouts based on the music. When we started, we wanted music and movements to be synchronized tempo-wise, so the music remains motivating, intensive and progressive. Our experience so far suggests that this relation may be much more complex: it seems that the cognitive strategies are (unconsciously) put into action for establishing this synchronization are various, and not necessarily in direct relation to rhythmic pulse.

1. Tempo, Pulse, Rhythm

Terms such as tempo, pulse and rhythm are often confused with one another: rhythm is a general term relating to many phenomena and concepts related with the way musical elements are structured over time. Tempo and pulse are among these concepts (along with many others such as meter, time signature, bars, etc.). According to musicologist Justin London, pulse (or beat) refers to “regularly recurring articulations in the flow of musical time”. More importantly, “the sense of pulse arises through the listener’s cognitive and kinaesthetic response to the rhythmic organization of the musical surface”⁷. In other words, the perception of it is rather subjective and may be interpreted differently from individual to individual. Finally, tempo is rather related to the way we express the perceived “speed” of the music. For example, a tempo of 120BPM (beats per second) tells us that each pulse/beat is separated by half a second, so that there are 120 beats per second. The problem, of course, is that the determination of tempo depends of one’s perception of pulse.

Nevertheless, previous research in sport and exercise has focused on tempo as the primary factor for reaching better results during training⁸. It has been shown that runners prefer music at a medium tempo of 120BPM (as opposed to higher tempi

⁷ LONDON, Justin: “Rhythm”, main entry in *Grove Music Online*, 2001.

<https://www.oxfordmusiconline.com/grovemusic/view/10.1093/>

⁸ KARAGEORGHIS, COSTAS, et PRIEST DAVID-LEE : “Music in Sport and Exercise: An Update on Research and Application”, in *United States Sports Academy, The Sport Journal* 11 (3), 2008.

<http://thesportjournal.org/article/music-sport-and-exercise-update-research-and-application/>

between 140-145BPM for example), because medium tempo helps them get into the “flow”⁹, that is, the reaching of a maximum state of concentration, engagement and satisfaction during an activity¹⁰. Scholars believe that this is due to people’s habit to listen to broadcasted music, whose tempo is most often in the medium range. Yet, tempo is a subjective parameter.

For example, for our song “Fly Away”, some users have indicated that it wasn’t “rhythmic” enough, that is wasn’t “moving” enough and that its BPM wasn’t high enough (Facebook or YouTube posts and comments, informal discussions, September-October 2019: around 100 users have expressed themselves freely and willingly).

[“Fly Away” 1:00]

And yet, its BPM is 132, but the drums, which plays what we call a “half-beat” riff, suggests a lower speed. In other words, depending of various factors, the pulse might be interpreted as half of its “actual” measurement. And then, at 2:00, the kick drum starts pounding on every beat, still at 132BPM. This time, people may start feeling that the tempo of the song has actually increased.

[“Fly Away” 2:00]

At the same time, other users have indicated that at other moments, Sophie was moving very fast, even though she wasn’t really. In other words, sound and music may influence our perception of movement and speed.

[<https://youtu.be/kXgXjwKYIbA?t=479>]: beginning at 7’30

Thus, there is the general ambiance of a song (for example, an impression of slowness) and, when we look (or listen) more carefully and locally, when watching a HIIT supported by music, we may have a different impression.

We thus note some confusion by users between what may constitute rhythm, tempo, pulse, speed, etc. In other words, it seems rather easy to make images and music say what one would like to hear or see... So, since it is a question of **perception** (therefore habits), why not use such perceptions for HIIT or other types of aerobic training. One of our objectives was precisely to better understand perceptions, so we could surpass them; all the more so because these perceptions seem to have been formatted, so to speak, by big American musical productions or remixes that often are overloading, both in terms of sound level and of timbre

⁹ Jabr, Ferris. 2013. « Let’s Get Physical: The Psychology of Effective Workout Music » *Scientific American*, 20 mars 2013. <https://www.scientificamerican.com/article/psychology-workout-music/>

¹⁰ Csikszentmihalyi, Mihaly. 1990. *Flow: The Psychology of Optimal Experience*. New York: Harper and Row; Csikszentmihalyi, Mihaly. 1997. *Finding flow: The psychology of engagement with everyday life*. New York: Basic.

content. As we've seen the case of "Fly Away", the music offers space for rhythmic interpretation despite the fact that it keeps a basic tempo of 132BPM.

In other words, a "synchronic" conception of music (that is, movements that are entirely synchronized to the music, such as "StrongbyZumba" for example), with which athletes are interpreting and experimenting through functional movements suggested by structural pulses, is indeed an interesting path, but not complete in our opinion.

2. Synchresis

We thus wish to explore a more encompassing hypothesis by summoning Michel Chion's model of audio-vision¹¹. For example, one could appreciate the relations between music and an athlete's movement configurations through what Chion calls the "added value" of the audiovisual relationship (5-9). For Chion the added value refers to:

the expressive and informative value with which a sound enriches a given image so as to create the definite impression, in the immediate or remembered experience one has of it, that this information or expression "naturally" comes from what is seen and is already contained in the image itself. (5)

For Chion, this added value emerges from *synchresis* that is "the forging of an immediate and necessary relationship between something one sees and something one hears"¹².

Method

How did we end up with this observation? Let's say first that our music pieces are designed with HIIT's progressive intensity in mind: 5-minute songs (instrumentals so far) that can be combined in many "blocks" according to how long one wishes to workout (ideally, between 10 and 20 minutes including short rest periods. Each HIIT we design consists of a series of movements following a progressive intensity curve, and the music is organized according to this intensity curve.

Moreover, rather than the loud "bips" traditionally used to indicate periods of activity and rest, it is integrated musical elements that notify the athlete-listener to alternate between these periods of activity and rest, thus making HIIT sessions become aesthetic experiences. Therefore, there is no need for disturbing sounds alien to the music, no need for loud or even aggressive countdowns, no need either for "blanks" between each pieces of music. Everything is included in a standardized 20s/10s pattern of alternation.

¹¹ CHION, Michel: *L'audio-vision - Son et image au cinéma*, Armand Colin, Paris, 4^e édition revue et augmentée, 2017.

¹² *Ibid.*, p. 5

For our experiment we had access to 15 songs that we were able to combine in HIITs of 5, 10, 15 or 20 minutes long, always with periods of activity (20sec.) and rest (20sec.), a ratio whose efficiency has been confirmed by research^{13,14}

Accordingly, in terms of music production, we used tempi that had some relationship with these durations of 20 and 10 seconds: 96BPM, 104BPM, 112BPM, 120BPM, 128BPM, 136BPM, 144BPM, etc. In fact, while songs at 96BPM allow for clear 4/4 metrical groupings (8 bars for 20sec. and 4 bars for 10sec.), we had to develop some kind of creativity to subdivide periods of 20 and 10 seconds for most of the other values. For example, for a piece at 128BPM in 4/4, we obtain 11 bars for 20sec. and 5 1/2 for 10sec... However, and surprisingly, these apparent limitations helped to develop a completely different approach to composition and sound design, questioning by the same token the cultural basis of the traditional 4-bars divisions found in most music in the the so-called Western world. Also, in order to follow a typical intensity progression curve, we've tended to include contrasting sections in all 5-minute songs, helping the listener to follow the mood. Conversely, it was sometime the music that suggested these intensity curves to Sophie who designed the movement sequences (more on this later).

Accordingly, for the rest of this contribution, we will first discuss HIITs for which music design *preceded* movement design, that is, HIITs that were recorded with music designed for this HIITs in particular. Second, we will discuss HIITs designed on existing Hits for HIIT music, and thus with movements that were not initially designed for these musical pieces. Finally, we have even gone as far as to substitute music used during the filming of some HIITs with different pieces of the Hits for HIIT music repertoire at the editing stage. This last strategy is analogous to the second one to the extent that movements were not designed with specific music in mind.

Corpus:

1. HIITs filmed and edited with specifically designed music:
HIIT 1 -2-6-7- 9- 14-19-20-21-44.

¹³ RIBEIRO et al 2018; KILPATRICK/GREELEY 2014.

¹⁴ That being said this ratio is specific to each performer's profile, for HIIT's main objective is to perform with the most effective work-time:rest-time ratio [30/30, 20/20, 30/15, 20/10, etc.] in order to remain as long as possible at one's maximum oxygen uptake (VO₂ max at 95-100%). Since Sophie Stévançe's VO₂ max is 177 (November 2019) she must reach a heart rate (HR) of about 163 BPM to perform an effective HIIT, what is allowed by a 20/10 ratio (this 20/10 ratio also allows us to use our musical pieces for 8- or 12-minute Tabata trainings). However, each performer has to train according to his/her own ratio (determined by his/her VO₂ max). This explains why HIIT must be performed by intervals: it is very difficult to maintain such intensity beyond 10-15 minutes of effective work (excluding rest time).

For example :

- HIIT 42 : <https://www.youtube.com/watch?v=5OINvNuGrHk> : One can see that the first exercise is synchronized with the music. Also, at 6:37, Sophie is clearly waiting for the music to begin before starting to move. This same behavior occurs in HIIT 48:
 - <https://www.youtube.com/watch?v=mcFXJ5vC1Yw&t=314s> : At 11:04, Sophie waits again for the music to start before moving. This also shows that she knows the music, which points to the importance of taking one's knowledge of the music used, something to study in further research.
 - Same observation for HIIT 44 : https://youtu.be/7OGDyzV2_a8: At 4:37 Sophie is mimicking the musical sounds.
 - Also in HIIT 47 : <https://youtu.be/neKfKsVSto8>: At 4:07 Sophie attempts to synchronize with the music, finally succeeding at 4:18.
 - Finally, HIIT 48 :
 - <https://www.youtube.com/watch?v=mcFXJ5vC1Yw&t=664s> : le mouvement est parfaitement synchronisé au rythme (à 18'35)
2. HIITs filmed with movements not initially designed for the music used during the filming stage: For example: HIIT 8-10-13-16-17-18-22 (Tabata)
 3. HIITs edited with music different from the one used during the filming stage For example: HIIT3-4-5-11-12 (Tabata: in this case we literally had to create a HIIT through editing because one of the cameras was stopped because of a Skype call...)

Comments by participants are telling: Synchronization between music and movements are pointed out independently of how the videos were produced. How could we explain this phenomenon?

Discussion

Chion¹⁵ mentions “points of synchronization” (or “synch points”) to designate “a salient moment of an audiovisual sequence during which a sound event and a visual event meet in synchronicity”¹⁶. A synch point thus occurs when there is a “vertical” correspondence between visual and musical elements. This encounter provides the audiovisual chain with its phrasing, its audiovisual syntax. Synchronism is deeply entrenched in our perceptive habits, meaning that we will mentally attempt to make up the absence of the sound's source by making this sound coincide with the current image instead.

¹⁵ CHION, Michel : *L'audio-vision - Son et image au cinéma*, Armand Colin, Paris, 4^e édition revue et augmentée, 2017.

¹⁶ *Ibid.*, p. 59.

Movement perception

As we have seen, sound may also influence our perception of a given movement and its apparent velocity. Some users have told Sophie that she was moving very fast during a given movement while it wasn't really the case. When we actually perform the movement in question, we realize that it is not that fast; but to watch it on the screen with sound gives the impression that it was performed with speed. (Song "Spy Beat", HIIT 44: https://www.youtube.com/watch?v=7OGDyzV2_a8: for example, see at 11:52; same impression at 02:09 during the "jumping Jack" movement.)

According to Chion, "basically, the ear analyzes, processes, and synthesizes faster than the eye"¹⁷. The understanding of a visual stimulus always takes a given amount of time, while "clearly delineated *sound* has the advantage of etching its form and tone directly into consciousness, where it can repeat as an echo" (61, Chion's emphasis). Sound will thus have the power to modify our perception of visual rhythms: "Depending on density, internal texture, tone quality, and progression, a sound can temporally animate an image to a greater or lesser degree and with a more or less driving or restrained rhythm"¹⁸. In short, depending on its sonic accompaniment, a same image may convey different rhythmic relationships as well as different apparent velocities. This encounter between two velocities—a sonic one and a visual one—will give rise to a third, proper audiovisual one.

Conclusion

The three audiovisual relations we just examined are directly linked to Chion's theory of perception. Indeed, Chion's "added value" and "synchresis" allow us, in principle, to better understand the reciprocal influence between image and music on our visual perception to the point of altering their apparent content or characteristics (and even when the image and its related sound are not subjected to one another). Furthermore, the context also influences our reaction, thus corroborating Sloboda's theory¹⁹ according to which music's influence entirely depends of the listening conditions, as well as on the listener's experiences and preferences.

Chion is calling for a "trans-sensorial perceptive theory". Indeed, he notes that in certain audiovisual works, hearing is the engine of sight and vice versa. According to him there are "auditives" of the eye²⁰. Chion explains our brain is the locus of sensorial encounters while hearing and sight are merely captors. In the same vein, in his book *Analyser un film*²¹, Juillier reminds us that in cinema, just as in everyday life, the separation of hearing and sight is artificial, because our brain was

¹⁷ *Ibid.*, p. 10.

¹⁸ *Ibid.*, p. 14.

¹⁹ SLOBODA, John: « The ear of the beholder », in *Nature*, 454 (7200), 2008, pp. 32–33.

²⁰ CHION, Michel : *L'audio-vision... Op. Cit.*, p. 132.

²¹ JULLIER, L. : *Analyser un film. De l'émotion à l'interprétation*, Flammarion, Paris, 2012.

trained to integrate or recognize images and sounds as part of a same phenomenon. This is also what somewhat come out from our experiments: a kind of “clip effect”²² during which sonic expression “instrumentalizes” visual matter. This was the case of the “Spy Beat” examples we have discussed above, and which appears again in other users’ comments, when audiovisual rhythm gives the impression of a high-speed movement.

The audible seems to become visible because of its interaction with the image: this is synchresis at play. As the combination of the words “synchronism” and “synthesis”, synchresis allows for a unique linkage of sound and image thanks to associations it creates instinctively within the spectators’ mind. And yet, there is no apparent hierarchy, and thus no dominance relationship, between sound and image: We remain in the realm of sport where, in the end, users are watching more than they are listening. They are under the impression that the more they hear rhythmic beatings, the more the music will be fast, and thus motivating. We plan to carry on with our research according to this hypothesis.

What can we learn at this point from our first experimentations?

1. That athletes usually believes that music is fast when there is a decomposition of the pulse (in addition to a saturation of the sonic spectrum).
2. That if we wish to bring athletes to understand (as we attempt to do with Hits for HIIT) that music may be fast without having to decompose the sound’s rhythm, we might need to use image.
3. Because even though we are not decomposing pulse, so it gives an impression of speed (or slowness for that matter), and even though we do not necessarily attempting to synchronise movements with music, users will synchronize mentally, which will gives the impression of speed (or slowness), or even an impression of fatigue!

Whole panoply of emotions that are projected through the audio-vision phenomenon.

²² JULLIER/PÉQUIGNOT : *Le clip: Histoire et esthétique*, Armand Colin, Paris, 2013.

Mediagraphy

BORRELI, Lizette : « Best Workout in 60- Second Intervals: High Intensity Interval Training Burns Fat, Improves Blood Pressure. » *Medical Daily*, 12 Juin 2015.

CHION, Michel : *L'audio-vision - Son et image au cinéma*, Armand Colin, Paris, 4^e édition revue et augmentée, 2017.

COMANA, Fabio: « HIIT, HVIT, or VIIT/ Which IT are you doing and do you know the differences? » *National Academy of Sports Medicine*, 1 Juin 2018.

<https://blog.nasm.org/author/fabio-comana/>

CSIKSZENTMIHALYI, Mihaly: *Flow: The Psychology Of Optimal Experience*, Harper and Row, New York, 1990.

____ *Finding flow: The psychology of engagement with everyday life*, Basic, New York, 1997.

JABR, Ferris: « Let's Get Physical : The Psychology of Effective Workout Music » *Scientific American*, 20 mars 2013. <https://www.scientificamerican.com/article/psychology-workout-music/>

JULLIER, L. : *Analyser un film. De l'émotion à l'interprétation*, Flammarion, Paris, 2012.

JULLIER/PÉQUIGNOT : *Le clip: Histoire et esthétique*, Armand Colin, Paris, 2013.

KARAGEORGHIS, Costas: *The Music Doctor: Dr Costas Karageorghis*, 2008:

<https://open.spotify.com/user/fitzdares/playlist/4dTGxWosQ87IqUUXvfXhmg>

KARAGEORGHIS, COSTAS, et PRIEST DAVID-LEE : “Music in Sport and Exercise: An Update on Research and Application”, in *United States Sports Academy, The Sport Journal* 11 (3), 2008.

<http://thesportjournal.org/article/music-sport-and-exercise-update-research-and-application/>

KARAGEORGHIS, COSTAS, LANE, TERRY : “Development and initial validation of an instrument to assess the motivational qualities of music in exercise and sport: The Brunel Music Rating Inventory”, in *Journal of Sports Sciences* 17 (9), 1999, pp. 713-724.

KILPATRICK, Marcus W. et GREELEY Samuel J. : « Exertional responses to sprint interval training: a comparison of 30-sec. and 60-sec. conditions », in *Psychological Reports* 114 (3), 2014, pp. 854-865.

LACASSE, Serge: « Slave to the Supradiegetic Rhythm: A Micro–Rhythmic Analysis of Creaky Voice in Sia's “Breath Me” », in *Musical Rhythm in the Age of Digital Reproduction*, sous la direction d'Anne Danielsen, Ashgate, Aldershot, 2010, pp. 141-155.

LONDON, Justin: “Rhythm”, main entry in *Grove Music Online*.

<https://www.oxfordmusiconline.com/grovemusic/view/10.1093/>

PETRI, Laukka et QUICK, Lina. 2011. “Emotional and motivational uses of music in sports and exercise: A questionnaire study among athletes”, in *Psychology of Music* 41(2), 2011, pp. 198–215.

<https://doi.org/10.1177/0305735611422507>

RIBEIRO Ramalho; OLIVEIRA, Bruno; MEIRELES SANTOS Tony, KILPATRICK, Marcus; OLIVEIRA PIRES, Flávio, et CAMAZ DESLANDES, Andrea: « Affective and enjoyment responses in high intensity interval training and continuous training: A systematic review and meta-analysis », in *Plos One* 13 (6), 2018.

SANCHEZ, Xavier, MOSS, Samantha L., KARAGEORGHIS, Costas I. et TWIST, Craig: “On the Role of Lyrics in the Music-Exercise Performance Relationship”, in *Psychology of Sport & Exercise*, Volume 15, Issue 1, January 2014, pp. 132-138.

SLOBODA, John: « The ear of the beholder », in *Nature*, 454 (7200), 2013, pp. 32–33.

STORK, Matthew; KWAN, YW; GIBALA, Martin J. et MARTIN GINIS, Kathleen. A: “Music enhances performance and perceived enjoyment of sprint interval exercise”, in *Medicine and Science in Sports and Exercise* 47 (5), 2015, pp. 1052-1060.

TERRY, Peter C. et KARAGEORGHIS, Costas I.: « Music in sport and exercise », in *The new sport and exercise psychology companion*. Sous la direction de Tony Morris et Peter. C Terry Morgantown, WV: Fitness Information Technology, 2011, pp. 359–380.