



Acoustic exposure, fire and belonging

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Abstract

Purpose

In Catalunya, devils are people belonging to 'Colla' (a group partaking in fire and drumming street performances called a 'Correfoc'. Many devils are part of a 'colla' for decades, thus exposing their hearing to extreme levels of sound several times a year. This can result in aural diversity and health being negatively impacted by the sound devils willingly expose themselves to.

This paper examines the intricacy behind the sense of belonging and why the health impacts do not seem to deter participation in 'correfocs', a temporary making of place in the city. It also explores why are fireworks producers keeping their product so loud.

Methodology

The methodology has been a combination between quantitative methods (survey to 'colles' to gather information on placemaking and sensory perception and the sense of community) with qualitative methods (interviews to devils and pyrotechnic manufacturers). There is also an autoethnographic component during fire season 2022.

Findings

There is a strong sense of belonging ascribed to a 'colla' and this influences devils to oversee their personal health. There is a tradition to pyrotechnical artifacts loudness that is now under review by the city, but change will be slow. The paper concludes proposing an aurally sustainable approach to partaking in this inherent element of Catalan popular culture.

Originality

The originality of this paper is its transdisciplinary approach (between urban sociology, aural studies, and sensory studies) and the bodily effects of place-making during a correfoc.

Keywords

aural diversity, popular culture, sustainability, place, community engagement.

Article Classification: Academic paper.

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Journal of Place Management and Development

Introduction: initial context

Catalunya (one of the autonomous communities in Spain) has a longstanding tradition of using fire in some form or another in popular culture contexts, fire has been present since 1394. It started as a presence in religious festivities where sometimes there would be some pyrotechnic artifact lit or a Fire Beast used in representations (Palomar, 2013). These uses of fire have evolved until the actual presence fire has in popular culture; it is deeply entwined in it (Ariño and García, 2012). For example, there are several occasions during the year where there will be a spectacle of fireworks one can watch from the distance, like some New Year's fireworks but at several festivities during the year. There is also a celebration that is deeply rooted in Catalan popular culture, in this paper we are going to focus on it, the 'correfoc' (fire run), more precisely we will focus on 'correfocs' in Barcelona.

A 'correfoc' is a fire performance where people dressed as devils run around and dance on the streets with pyrotechnic artifacts somehow like fireworks followed by a band of drummers. Devils are people belonging to 'colla de foc' - from now on referred to as 'colla' - (is a social group, normally an association partaking in fire and drumming street performances called correfocs) that carry and dance with fireworks and firecrackers at the end of a wooden stick. There are several 'colles' in Catalunya. In some cities, like Barcelona for example, there are many,

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3 some neighbourhoods having 3 or more. A 'correfoc' creates a temporarily very
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6 loud and visually attractive ambience, it also re-signifies place temporally. It is a
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9 loud and rhythmical ball of fire dancing and jumping through a street. Firecrackers
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11 and pyrotechnic artifacts whistling and exploding produce sounds at high volume,
12
13 sometimes reaching 175dB. The sonic intensity of these performances has to do
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15
16 both with the sound emanating from the pyrotechnic artifacts and drums, and the
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18
19 reverberation the streets of Barcelona can create. The devils are accompanied
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21
22 by a drumming soundtrack played by 'tabalers', devils that do not burn, they play
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25 drums (Berrens, 2022; Colombo *et al.*, 2021; Massana, 2015).
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32 There can be different sections in each 'colla', for example it can have a children's
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35 section. This section needs a lot of assisting adults for several reasons, the first
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38 one is that individuals under the age of 18 years old are not allowed to touch F2
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41 or F3 pyrotechnia and, as such, the adults are the ones placing the firecracker at
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43
44 the end of the wooden stick ('maça') for each devil. There also is a ratio of children
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47 per adult that needs to be respected during a children's correfoc. There are also
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50 be underage drummers that accompany their peers while they burn pyrotechnic
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53 artifacts. In addition, there can be a section with a Fire Beast (an animal figure
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56 that is mobile and has several points to attach fireworks) having some devils
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59 outside the Beast which can burn too or not. The Beast can be accompanied by
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61
62 drummers, these may be from the same section as the Beast, another section in
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64
65 the same 'colla' or a different drummer group altogether. Most 'colles' will have
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3 adult section (devils aged over 18 years) and this section will have its own group
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6 of drummers.
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11 Plate 1. Devil carrying a 'maça'
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41 Source: made by the author
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46 Within these sections we find that the children will carry special pyrotechnic
47
48 artifacts that are less loud (normally type F1 but I will expand on this later) and
49
50 are obliged to wear protective gear in their eyes with either a shield or protective
51
52 glasses. They also wear gloves and are not allowed to touch or manipulate the
53
54 artifacts. Adults will always accompany children to put in the pyrotechnic artifacts
55
56 at the end of the 'maça', a long wooden stick with a metallic spike to put the
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3 firecrackers on (Berrens, 2022) and take it off when it has exploded. In this sense,
4
5
6 it is important to note that a child can become a devil aged 10 and they pass onto
7
8 the adult section of the 'colla' when they turn 18. They can start drumming in the
9
10 children's section when they are 7. This is a rite of passage, both into adulthood
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12 within the 'colla' and into the group of people who can then manipulate
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14 pyrotechnic artifacts.
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22 In this sense, we can see that a devil can start partaking in correfocs from a very
23
24 young age and can stay in the 'colla' for decades, thus exposing their hearing to
25
26 extreme levels of sound repeatedly every year for many years. During peak
27
28 season (March to November) this exposure can happen several times a week.
29
30 This results in many devils having varying levels of aural diversity and their health
31
32 being negatively impacted by the sound they willingly expose themselves to. This
33
34 aural diversity is often worn as a kind of “badge of belonging” and commitment to
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36 the 'colla' (Berrens, 2022). Belonging to a 'colla' and partaking in these popular
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38 culture festivities has an implication with the sense of belonging to Catalan
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40 popular culture and there is a pride ascribed to it, it also has an implication in the
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42 engagement with non-hierarchical social structures (associations) that drive
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44 bottom-up approaches to social organisation and processes, spatial use and
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46 community formation. There is a strong emotional link to the 'colla', and it plays a
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48 role in the identity formation of its members and the perception of the
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3 neighbourhood (Berrens, 2022; Colombo and Cantó-Milà, 2019; Colombo *et al.*,
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6 2021).
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11 This paper will first explain the different kind of pyrotechnic artifacts typically used
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13 in a 'correfoc' and their construction and sonic impact. It will then analyse the data
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15 gathered from burners and the interviews with pyrotechnic artifacts' makers.
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17 Overall, the paper examines the intricacy behind this sense of belonging and the
18
19 reasons why the health impacts do not seem to deter participation in 'correfocs'.
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21 It also examines why are manufacturers keeping their product so loud. It
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23 concludes proposing an aurally sustainable approach to partaking in this inherent
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25 element of Catalan popular culture.
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34 35 Our Colla

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40 I have been a devil since 2017 in "La Vella de Gràcia" (The Old 'colla' from Gràcia)
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42 and Farrofoc. The latter is a newly formed 'colla' in the Farró area in Barcelona,
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44 the former is one of the oldest fire groups of my neighbourhood, Gràcia, in
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46 Barcelona and is the 'colla' I will be referring to in this paper unless otherwise
47
48 stated. Our 'colla' has been active for over 40 years and is a "spin-off" from the
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50 'colla Vella de Sitges' which is a 'colla' from a coastal village 40 km west of
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52 Barcelona called Sitges. The latter has been active since 1853, having continuity
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54 since 1903 (except from the Spanish civil war years). The 'correfoc's' tradition is
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3 far longer than this. It started as a play between devils and archangel Saint
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5 Michael called 'Ball Parlat' (Spoken Dance) and, over time, has evolved to the
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7 street celebration it is now (Berrens, 2022; Massana, 2015). Ours has three
8
9 sections, Malsons (Nightmares) which are the children, Adulta (Adult) for the
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11 people aged over 18 and Atzeries (Atzeries) which is our beast and its devils.
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13 The beast is half devil, half buck, it is over 3 meters tall, is anthropomorphic
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15 (particularly in its manicured hands with long nails) and has several attachments
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17 for firecrackers, there are also devils that burn with the Beast while the drummers
18
19 play traditional beats. All sections have devils that burn (devils from now on) and
20
21 'tabalers' (drummers). Both Malsons and Adulta have special "figures" (devils
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23 dressed different than the others and that use bigger maces to burn), those are
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25 Devil Lucifer and a She-devil figure (Berrens, 2022).
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34 Malsons celebrated their 15th anniversary in May 2022 and Atzeries celebrated
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36 its 5th on May 2021. Overall, it is a very well established 'colla' in Barcelona and
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38 in Catalunya.
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42 Counting all sections, we are above 65 people. The adult section of the 'colla' has
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44 a steady participation in 13 correfocs every year at least, plus the ones that
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46 Malsons and Atzeries do on their own or to the ones to which the whole 'colla' is
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48 invited. We won third position in the 1st Catalan Fire contest in 2018. This is a
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50 contest where different Catalan 'colles' come and participate by doing two big fire
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52 performances and they are evaluated according to different criterion set by a jury.
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3 Farrofoc is a much smaller group, having only the adult section with their own
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5 drummers. They have a Lucifer and a She-devil figure with special maces called
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7 'ceptrots'. It was formed in 2017 by a group of friends, most being parents from
8
9 the same primary school. It started with few correfocs and is slowly widening its
10
11 scope beyond the Farró area into other areas of Barcelona and cities in
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16 Catalunya.

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22 Plates 2 and 3: (Fg 2) Lucifer and She-Devil from Farrofoc 'Colla'. (Fg 3) Detail
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24 of the Owl 'Ceptrot'.



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54 Source: made by the author.

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3 Each 'colla' has some elements that relate to their area or neighbourhood
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6 (Colombo *et al.*, 2021). For example, Farrófoc's logo is an Owl because it refers
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8 to a legend of a big Owl that used to live in Putxet Park (the park in this
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10 neighbourhood) and would hunt at night and be seen flying over certain areas of
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12 Farró. One of its 'ceptrots' (special 'maça') is therefore, an owl.
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27 Plate 4. Farrófoc's logo imprinted of the fireproof clothing.



49 Source: made by the author

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54 A 'correfoc' will follow a pre-defined route through the streets of Barcelona or any
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56 village. It is a musical, pyrotechnic and playful dance event. It consists of devils
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58 jumping and dancing around the streets with spectators running into the space
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3 the devils are dancing and making playful human barricades to stop the devils
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6 from advancing in the route. Devils can also be lifted in the air by spectators. The
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9 interaction tends to be playful and in the last few years there is an increasing
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11
12 number of children coming to 'correfocs' (with the appropriate clothing and
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15 protection) that also want to play under the fire sparks that the pyrotechnics emit.
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18 Devils will normally dance while advancing, making a single or a double line
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21 (either one or two devils at a time) while the firecracker at the end of their 'maça'
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24 is still going, then they stop, return to the beginning and get another one and
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27 restart. At certain intersections in the route, all devils gather to burn the
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30 firecrackers at the same time, this is called a "joint burn". They form a circle and
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33 all light their firecrackers simultaneously, then taking two steps backwards and
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36 creating a ball of fire, all jumping together in a circle until the last firecracker
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39 explodes. We can see that a 'correfoc' has a noticeable amount of "back and
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42 forth" and, as such, does not follow linearly the predetermined route. Therefore,
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45 a single 'correfoc' with a 2km route can take over an hour for a single 'colla' to go
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48 from start to finish. In addition, whenever there is a Correfoc, there are several
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51 'colles' participating. So, there is a queue of 'colles', each burning separately
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54 during the route and then having a communal, massive burn at the end of the
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57 route, when all 'colles' have arrived.

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60 This brief explanation of the functioning of a 'correfoc' is to illustrate the amount
of time devils spend in the many 'correfocs' they partake in per year, and as such,

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3 the number of decibels their ears are exposed to several times a year for
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6 extended periods of time.
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10 11 Pyrotechnics 12 13 14 15 16

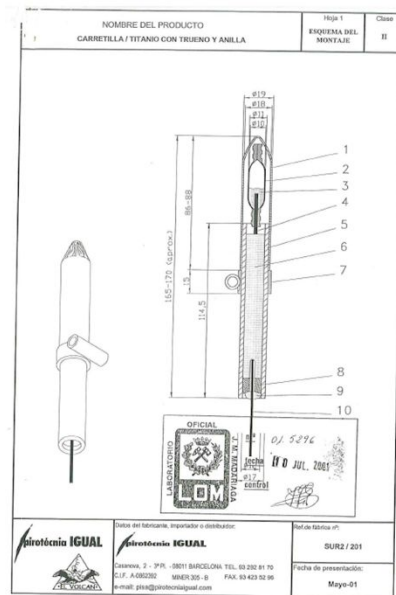
17 The firecrackers and fireworks we use in correfocs are done in four main factories
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19 in Catalunya, Catalana, Estalella, Garcia and Igual. I have interviewed two of
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21 them in order to get a deeper understanding of the construction of the main
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23 fireworks we use.
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30 The Malsons use specific pyrotechnic artifacts approved for minors, though they
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32 are not allowed to touch it and thus require of an adult to put in on the 'maça', lid
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34 it and take it out when it has exploded. Their pyrotechnia does not have a thunder
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36 and are much quieter than adult pyrotechnia. I will explain the different types of
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38 pyrotechnic artifacts at the end of this section.
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45 Atzeries uses larger pyrotechnia, almost no 'carretilles' and usually mostly
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47 'sortidors' or 'titanis'. In this sense, Atzeries's firepower is stronger and thus louder
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49 than the devil's habitual pyrotechnia and lasts for longer (this is due to the fact it
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51 has more gunpowder combined with a longer tube, so it takes longer for it to
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53 burn). It also has a louder thunder.
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We mainly use four kinds of pyrotechnic artifacts, 'carretillas' (with 'xiuladores', and 'roncadores' included), 'sortidores' (with 'titanis' and 'francesos' included), 'bengales' (with 'candelas' included) and 'sortidores' with 'volcanet'. 'Carretillas' are the simplest of the four; it is a cardboard tube with a wick on one end and a pointy cardboard end (where the 'thunder' – the part that makes the loud bang at the end is). The tube itself is filled with a specific mix of gunpowder with other compounds (the exact recipe is trademarked).

Figure 1. Diagram of the structure of a 'carretilla'.

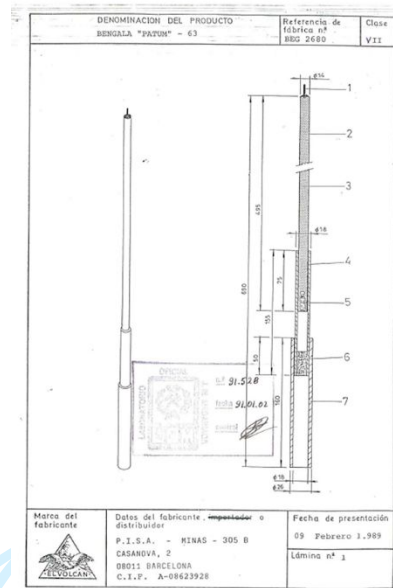


Source: DOGC 2016. F1.1

Other kinds of 'carretillas' widely used are 'xiuladores' or 'roncadores'. Like 'carretillas' in size but 'xiuladores' emit a whistling sound from ignition to thunder explosion and 'roncadores' a much more bass like sound like snores ('roncadores'

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3 means the snorers, 'xiuladores' means the whistlers). Both have a thunder like
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5
6 'carretilles'. The 'sortidores', ('titanis', or "francesos are the ones we use the most)
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8
9 are thicker sorts of 'carretilles' that last longer and have a louder thunder. The
10
11 colour of the sparks may vary but that does not vary the sound it makes. The
12
13 thunder is built separately from the composition that gives pyrotechnia's spark
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15 their colour. 'Bengales" have no thunder, they are what is commonly referred to
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17 as flares. 'Patums' are part of this family, longer and thinner than 'carretilles', they
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19 have a low combustion speed and make a rustling sound that is much quieter
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21 than any other pyrotechnic artifact, the visuals sensation is that of a slow rain of
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23 very thin orange sparks.
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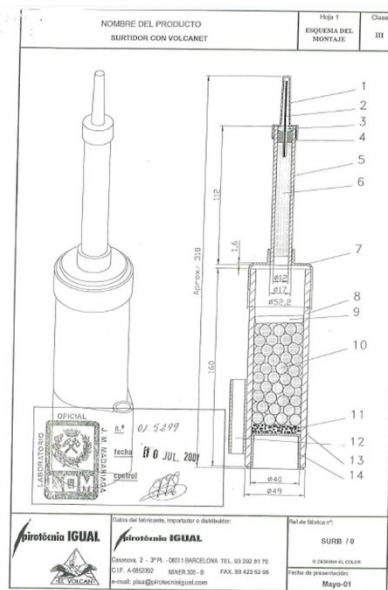
45 Figure 2. Diagram of the structure of a 'Bengala'.
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Source: DOGC 2016. F1.1

Then the 'volcanets' are artifacts to be put vertically on the 'maça', the gunpowder composition can emit a variety of colours (and be multicoloured) and at the end the thunder is a loud bang that sends small, coloured burning "small balls" vertically projected into the air (DOGC 2016). Pyrotechnic artifact is classified by type, there are 4 types. The classification depends on the amount of gunpowder and the type of thunder.

Figure 3. Diagram of the structure of a 'Volcanet'.



Source: DOGC 2016. F1.1

Pyrotechnic artifacts have three main parts, the detonating matter (what is used to make the thunder and open the pyrotechnic artifact), the pyrotechnic matter (what is used to produce non detonating effects, the colours, the sparks) and the inert matter (carboard, capsule, any other element) (DOGC, 2016). The volume of each pyrotechnic artifact is tested individually and depends on three aspects. First, the bigger the pyrotechnic artifact is, the louder it will be. Then, it depends on the kind of thunder used, it can be louder if it has more detonating matter. The last element is the pyrotechnic matter used in the main tube; depending on its composition (manufacturers' do not share the detail of the compositions) it will make the pyrotechnic artifact louder (for example, 'xiuladores') or burn for longer (for example 'patums').

According to the Catalan regulation of fire, called ITC-18, categories are as follow:

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3 "Category F1: Pyrotechnic artifacts with a very low dangerousness and an
4 insignificant sonic level destined to be used in delimited areas, including the
5 pyrotechnical artifacts destined for residential indoor use.
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11 Category F2: Pyrotechnic artifacts with a low level of dangerousness and low
12 sonic levels destined to be used in open air areas in delimited areas.
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16 Category F3: Pyrotechnic artifacts with a medium level of dangerousness
17 destined to be used in vast open-air areas, with a sonic level that is not harmful
18 for human health.
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23 Category F4: Pyrotechnic artifacts with a high level of dangerousness exclusively
24 destined to be used by professionals and with sonic level that is not harmful for
25 human health" (DOGC 2016, pp.2-3).
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35 When the regulation is stating "a sonic level that is not harmful for human health"
36 is refers to the statutory Health and Safety regulations which determine 120dB
37 as the threshold of pain for human hearing. The issue with this is that it is
38 measured individually, one pyrotechnic artifact at a time.
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45 Ignition can be manual through the wick or electric through an electric ignitor that
46 is previously incorporated into the pyrotechnic artifact.
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53 Regulations are clear on not modifying the pyrotechnic artifact in any way, may
54 that be to change the ignition points or system or any other modifications of the
55 artifacts themselves. They can be connected through external wicks. These can
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3 be either normal wicks or retardant wicks, meaning that one artifact will have to
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6 be fully consumed before the next one ignites.
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11 There are four more categories in two different groups. Artifacts to be used on
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13 top of stages (T1, T2) and other uses (P1 and P2).
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19 Devil 'colles' are allowed to use F1, F2; F3, T1 and P1.
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22 The ages are also regulated accordingly to their dangerousness. F1 is to be used
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24 by 12+ year olds, F2 by 16+ year olds, F3 by 18+ year olds and T1 and P1 by
25
26 18+ year olds. F1 and F2 ages may be reduced, upon a justified previous request
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28 to 8- and 10-year-old respectively so that children devils can use them. However,
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30 their use must always be supervised by the legal guardian, parent or tutor (DOGC
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32 ,2016).
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40 ICT-18 regulations also state the ways in which pyrotechnical artifacts must be
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42 transported (transport is limited to 15kgs of regulated matter (detonating matter
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44 + pyrotechnic matter), manipulated between beginning and end point and stored.
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46 They also state rules for the transportation of pyrotechnic artifact during
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48 correfocs.
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3 The regulation does state the clothing needed to use the pyrotechnic artifact, it is
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5 fireproofed clothing and hats, gloves and glasses. There is no mention of sonic
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7 protection in the regulation.
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10 11 12 13 14 Methodology

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19 This research is methodological bricolage brought on by the Covid-19 pandemic
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21 (Kusenbach, 2003; Murthy, 2008; Yardley, 2008). As mentioned earlier, this
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23 article builds on a previous article exploring nosiception and sense of belonging
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25 during a 'correfoc' (Berrens, 2022). For this article, the methodology consisted of
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27 a new online survey (referred to as second survey) distributed to devils from three
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29 'colles' in Gracia across different sections. The survey had a quantitative section
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31 with multiple-choice questions and a qualitative one with open questions. The
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33 second part of the methodology is qualitative with focus groups, and semi-
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35 structured interviews. On the one hand there were online surveys, then there
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37 were semi-structured interviews to several devils of the 'colles' and pyrotechnic
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39 artifacts' manufacturers.
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51 The survey was distributed online to the same devil's groups I had been doing
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53 research with previously, colles in Barcelona (Berrens, 2022). These groups have
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55 different sections, and the first survey was passed indiscriminately of age or role
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57 within the group to all. The second survey was only passed to "burners" (devils
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3 that burn in a 'correfoc', not drummers) in all sections. There were 64 replies to
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5 the first survey and there are 39 replies to date to the second phase survey (both
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7 are still open). In the results we will focus on the results of the second survey.
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9 When considering that there are a lot less devils than drummers in any given
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11 'colla', this is still a significant sample in the frame of this research.
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19 The surveys were used to guide the interviews. There were 12 follow up
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21 interviews for survey participants, these were done to devil's who were interested
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23 in having a follow up interview through an open call for devils to be interviewed.
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25 The survey took place during 2022 and the interviews during the same year.
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27 There is an ongoing autoethnography during 2022 fire season that has enabled
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29 the grounded theory analysis to be further informed.
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34 There were also two initial interviews done to pyrotechnics manufacturers in
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36 Spain, followed by two more in depth interviews to the same main pyrotechnics
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38 manufacturers. This was expected to gather precise data on the manufacturing
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40 of pyrotechnics to see how is sound calibrated in a pyrotechnic artifact and
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42 examine health impacts in manufacturer's workers too.
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50 The quantitative questions results are presented as percentages. The survey's
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52 open questions and interviews have been analysed using thematic analysis and
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54 grounded theory seeking to understand the relationship between place, a
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56 'correfoc' and the relationship between aural diversity, community engagement
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3 and belonging to a 'colla'. For the manufacturer's interviews we were seeking to
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5 understand the way the artifacts are produced and the testing they undergo,
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7 options for quieter products and hearing diversity (Wetherell 1998; Liu 2016).
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10 11 12 13 14 Findings 15

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18 From the survey, we can see that 82,1% of the answers to the survey came from
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20 devils aged 18 or over (51.3% of the respondents are between 31-50 years old,
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22 and the same 17,9% are 51-70 and 12,8% are 18-30) and then 17,9% are 10-17.
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24 Then 66,7% are from La Vella de Gràcia, 20,5% from other 'colles' and 12,8%
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26 from Malèfica del Coll. 66,7% of the respondents are in the adult section, 28,2%
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28 in the childrens' and 12,8% in the Beasts' section of their respective 'colles'.
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36 We observe that 61,5% of devils had been in a 'colla" for over 5 years, if we take
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38 into consideration that 64,1% of the respondents participate in over 6 correfochs
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40 per year, and an extra 28,2% participate in over 10 Correfochs per year, we can
41
42 gather the frequency of exposure to a very loud environment for a prolonged
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44 period. In addition, 66,7% of survey respondents affirm not to use ear protection.
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49 Some of the reasons given for this were feeling "too isolated", or being "used to
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51 the sound", for some having an extra piece of gear was "uncomfortable", for
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53 others priority is given to security in hearing instructions over self-preservation
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55 and finally a group of devils said that they wanted to hear the fireworks because
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3 they liked the soundscape a correfoc creates. The 33.3% that wears earplugs
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5 mostly wears foam earplugs (85%) with the remaining 13% wearing plastic ones,
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8 one of them wears bespoke plastic earplugs made specially for 'correfocs').
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14 Moreover, we can observe that 33.3% of devils said that 'correfocs' had had an
15
16 impact on their hearing ability, from hearing loss (25,6%) to several variations of
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18 temporary aural diversity straight after a correfoc for the remaining devils.
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22 There is a 38,5% of devils that has acquired aural diversity (15,4% in the last 1-
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24 4 years, the remaining 10,3% in the last 5-10 years). Overall, a 15,4% of devils
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26 were getting medical treatment for their aural diversity. Of those surveyed, a
27
28 28,2% thought this acquired aural diversity was in fact due to the exposition to
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30 correfocs' sound.
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34 In addition, 15,4% of devils lived negatively this aural diversity, while 28% said it
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36 did not bother them. Over a third (38.5%) of all devils surveyed agreed with the
37
38 statement that ending up with hearing issues is part of being a devil. Upon asking
39
40 what is their lived experience of this altered aural perception, 15.4% said it was
41
42 a negative experience, while 28.2% said it made no difference for them. Finally,
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44 devils were asked what they think about changes in hearing. 17.9% stated it is
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46 normal for it to happen, 5.1% said it will happen to all the devils, 5.1% said it will
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48 only happen to the devils that are really invested, a further 51,3% of devils thought
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50 that acquiring aural diversity was going to happen to devils who do not wear ear
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52 protection.
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4 There was a draw when asking if the devils were relating this aural change to
5
6 their belonging to the group, 20.5% agreed, while the other 20.5% disagreed (the
7
8 remaining 59% said it did not apply to them), 5.1% of devils stated that having
9
10 some sort of aural diversity does impact on their sense of belonging to a 'colla'.
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16 However, the result from the interviews is quite different. The selection of
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18 interviewed participants was not done according to their survey questions, an
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20 open call for an interview was issued amongst the survey respondents. We gather
21
22 that the devils that came forward for an interview were interested in the research
23
24 and the sonic impact is something they likely think about.
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32 From those interviewed, a 69% did use ear protection and 90% had noticed an
33
34 aural change between their hearing before and after the correfoc. It could be
35
36 either temporary or a change that has, for example, prompted them to decide to
37
38 start using protection. When talking about whether devils would acquire diverse
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40 aurality as a result of correfocs, 95% of interviewed people agreed (with the
41
42 difference to the 51,3% of surveyed individuals). However, they saw personal
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44 protection as a solution instead of less volume for pyrotechnics.
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50 Along these lines, 90% of interviewed devils would not like to have silent
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52 'correfocs' or the pyrotechnics made less loud.
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3 The findings also show that 38,5% of surveyed Devils, 70% of interviewed Devils
4 and 100% of interviewed Pyrotechnics manufacturers have suffered from some
5
6 kind of aural diversity either after a 'correfoc' or after testing pyrotechnics.
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12 From the interviews with manufacturers, we gather the louder part in a
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14 pyrotechnic artifact is the thunder. It has a double objective; on the one hand it
15
16 wants to contain the gases emitting from the burning of the compound in the main
17
18 chamber and it has its own compound that makes a loud bang when it explodes.
19
20 The intensity and sonic level of the thunder depends on the compound in this
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22 small capsule. At an 8m distance a 'carretilla's' thunder will be between 96-
23
24 101dB. Children's thunder will range between 70 and 83dB. Manufacturer's will
25
26 do random tests in each batch produced to see if the artifacts comply with the
27
28 regulations (in this case it's the standard health and safety regulations that state
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30 that the maximum permitted sonic level is 120dB, very close to the human
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32 threshold for pain).
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45 Another manufacturer states that the sound in the thunder is very tightly
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47 controlled because it can lead to strong hearing injuries. If at any control, a
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49 thunder is louder than what is it supposed to be, the whole batch is thrown away.
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51 Moreover, 100% of the manufacturer's interviewed stated that the environment in
52
53 which the sonic levels are measured is nowhere near the reality of where the
54
55 pyrotechnic artifacts are used, that the reverberation, the area's layout (if there
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3 are many or few trees, if it's an open space, if it's a narrow street with tall
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6 buildings, if it is a wide street...) or also if more than one pyrotechnic artifact is
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9 used at the same time will have a significant impact on the overall sonic levels.
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14 Discussion

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20 As indicated in the introduction, in this paper we have been examining the
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22 relationship between the sense of belonging and the reasons behind this fidelity
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24 to participating in 'correfocs'. We have seen the composition and history of two
25
26 'colles' and seen that fire has been present in Catalan Popular history for over
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28 centuries,
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32 To better inform this discussion I will also draw on the main findings from the first
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34 survey reviewed in my previous paper (Berrens, 2022).
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40 As seen above, more than half of the surveyed devil are 31-50 years old and that
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42 61,5% of them have been in a 'colla' for over 5 years. In addition, 64,1%
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44 participate in over 6 'correfocs' per year, with 28.8% going to more than 10
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46 'correfocs' per year.
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52 This means that their hearing has been consistently exposed to 'correfocs' for
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54 over 5 years with a noticeable frequency. We have also seen that 66,7% of
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56 individuals surveyed do not use ear protection. All together we can notice there
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3 is a frequent exposure to loud sound without an appropriate protection, or any
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6 protection at all for two thirds of devils. It is striking to see there is a detailed
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9 regulation on pyrotechnic artifacts but no regulation on ear protection. In the
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12 sense that, falling inside the scope of the health and safety, one would expect
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14 that there would be a regulation for ear protection (DOGC, 2016).
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19 From the interviews, we gather that the devils using ear protection do so because
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21 they had problems with their hearing (may that be temporary or permanent). This
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23 led them to prefer to use protection and deal with having to listen more carefully
24
25 for the Fire chief's instructions than to carry on damaging their hearing. Some
26
27 devils stated the reason they do not want to wear (and don't) ear protection is
28
29 because otherwise they do not have the same connection with space and their
30
31 making of place is different, pain or hearing damage is accepted in exchange for
32
33 hearing clearly the Fire Chief and being part of a spectacle that is immersive
34
35 sensorially (Berrens, 2019; Berrens, 2022; Imrie, 1996; Schartzwz, 2003;
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37 Schartzwz, 2011). However, at no point have they considered ceasing to partake
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39 in the activities that are either actively damaging or contributing to further damage
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41 their hearing abilities. As explained earlier, fire is deeply embedded in Catalan
42
43 popular culture (Palomar, 2013; Massana, 2015) and there is a strong sense of
44
45 belonging to the 'colla', as seen with the 39% of surveyed devils having been in
46
47 the 'colla' over 10 years. There is a sense of belonging to the 'colla' combined
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49 with a pride in undertaking the liturgy typical of 'correfocs'. Historically these have
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4 been loud, hence it is assumed that the loudness is intrinsically part of the
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6 'correfoc'.
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11 As seen, over a third of surveyed devils and over 80% of interviewed devils state
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13 that having hearing diversity is a consequence of being a devil. The interviewed
14
15 devils traced a fine line between the need to hear the Fire Chief's instructions and
16
17 their hearing, there was discussion on which would be the best kind of earplugs
18
19 to prevent hearing damage and still enjoy and feel they partake in the 'correfoc',
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21 this enjoyment also came from a sense of safety once the visual anchor in our
22
23 occularcentric society is no longer reliable because of the amount of smoke there
24
25 is (Berrens, 2015; Latour, 2004). A 'correfoc' can be very loud, it can reach 175dB
26
27 depending on the composition and layout of the space in which it takes place, the
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29 pyrotechnic artifacts used and the number of 'colles' and devils in each 'colla'.
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40 As seen above, the manufacturer's test each pyrotechnic artifact individually,
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42 making sure its overall sonority does not reach above what it is intended to be
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44 and, in no case, goes above 120dB. This is not an accurate sonic test of the real
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46 conditions that are in a 'correfoc' at any given time, it can reach 175 dB (Berrens,
47
48 2022). In response to the sonic intensity generated by 'correfocs', there is a
49
50 movement in Catalunya for 'correfocs' to lower their volume because of the
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52 impact they can have on wildlife and domestic animals. Dogs are known not to
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3 like the thunder of pyrotechnic artifacts and get very scared. (Gates *et al.*, 2019;
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6 Shamoun-baranes *et al.*, 2011)
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8 This movement is also asking for silent 'correfocs" and pyrotechnic spectacles.
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11 As one of the interviewees mentioned, in the Arab Emirates they have done some
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14 spectacular silent displays of drones with lights that, to some extent, mimic the
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17 aesthetics of a pyrotechnical celebration such as New Year's fireworks. These
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20 spectacles are done with many small drones that emit lights in a certain rhythm
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23 while they fly in the air with a pre-designed pattern. Albeit being an interesting
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26 luminous spectacle, this does not replace something like New Year's celebrations
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29 in terms of fire spectacle. Many devils are opposed to the pyrotechnic artifacts
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32 becoming quieter, they consider it wouldn't change the 'correfoc', it would not
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35 even be one but something completely different. For them the 'correfoc' is a multi-
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38 sensory experience and sound cannot be disassociated from it.
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40 There have also started to emerge pyrotechnia manufacturers that make less
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43 loud and more eco-conscious artifacts, with recycled cardboard, low grammage
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46 for thunders and a maximum volume of 97dB which is what the factory
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49 technicians consider the volume of a conversation outdoors during daytime in a
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52 city (Arqué, 2023).
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55 We can conclude with the exposition that there is a growing social consciousness
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58 about the volumes in 'correfocs' and pyrotechnic artifacts. It is interesting to see
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3 alternatives emerging both in terms of lessening the volume and about making
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6 sound-free spectacles. The future of 'correfocs' is unlikely to be silent, there is
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9 too much resistance from people already in this tradition and it would entail a 180
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11
12 degree turn on a key component of Catalan popular culture. However, a move
13
14 towards more sustainable (recycled) and conscious (with smaller thunders)
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16
17 pyrotechnic artifacts is already underway. Whether this will change this tradition
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19 or generate a "silent spin-off" from 'correfocs' is yet to be determined.
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