

Human towers or *castells* modelling

Presented by the Coordinadora de Colles Castelleres de Catalunya

1 Introduction

A *castell* or human tower is a Catalan tradition unique in the world. Dating from the 19th century, it has been increasing its popularity over the last years. On 2010, Unesco included the castells in the list of Intangible Cultural Heritage of Humanity (see [4]). As their motto claims, castells are a combination of strength, balance, courage and *seny* (a Catalan word for good sense and calmness).

In Catalan, the word *castell* means castle, and the complexity of each of these human structures depends both on the number of people (*castellers*) forming each floor and the number of floors. Roughly speaking, and for simple structures, the higher or thinner the more difficult the *castell* is.

The basic structure of a *castell* consists of three parts (see Figure 2): the *pinya* (or basis), the *tronc* (the vertical part of the castell) and the *pom de dalt* (the top three levels of the *castell*, with the *enxaneta* at the highest one). A *castell* is accomplished if the child called *enxaneta* has climbed to the top of the *castell*, she or he has raised her or his hand and the *castell* has been successfully dismantled (or *descarregat*) afterwards. If the *castell* falls down once the *enxaneta* has raised his or her hand, it is said to be only *carregat*.

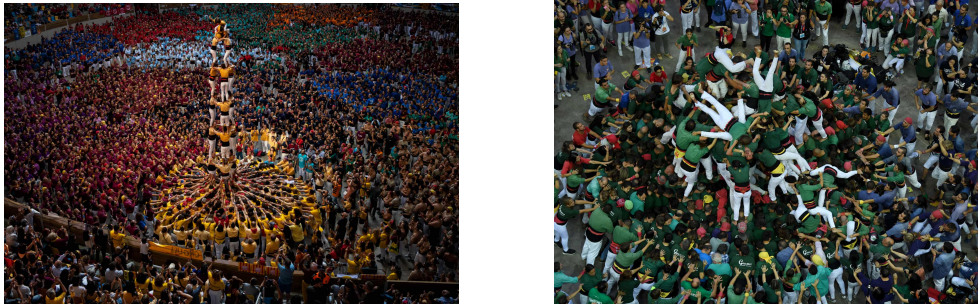


Figure 1: 3d8 of the *colla* Bordegassos de Vilanova (left), image over the *pinya* once a castell has fallen down (right). Photos at the biannual *castells* competition at Tarragona, from [The Guardian](#).

The *castells* are raised in festivals hold around all parts of Catalonia, especially in the regions of Tarragona and Penedès, from where they are original. They are performed by teams or *colles*, each of them of a different town or village (or neighbourhood), that can be distinguished by the colour of their shirt. People from all the ages, genders and backgrounds form the more of the

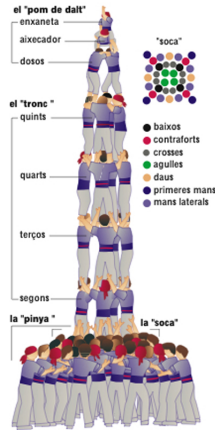


Figure 2: Structure of the 4d8 *castell* (photo from Fototeca.cat).

90 *colles* that can be found in Catalonia nowadays.

The Coordinadora de Colles Castelleres de Catalunya (CCCC) is the *colles* coordinating body. One of its tasks, among others, is helping the *colles* in improving safety and prevention when doing *castells*. One of their projects was, for instance, implementing the use of helmets in the children of the *pom de dalt*, to protect them in case of a fall.

2 Problem description

One of the Coordinadora current projects involves the safety of the members of the *pinya* or basis when a fall down of a *castell* occurs. In order to increase their protection, the Coordinadora is studying the possibility of implementing the use of a cervical protector for those *castellers* that are in the parts of the *pinya* where the *castell* is more likely to fall onto. To this purpose, they would like to have, for each type of *castell*, a “map” of the zones of the *pinya* where the *castellers* are more likely to fall onto and the intensity of this fall, as the location of the falls is not uniform. This map would also allow them to know the minimum size of the *pinya* needed for building each type of *castell* in a safer way.

From a modelling point of view, this project can be divided into two problems. The first one would consist of developing some kind of model for each type of *castell* in order to explain and study which are the mechanics that allow a *castell* to be build and, of course, which are the factors that cause a *castell* to collapse. Apart from helping in understanding the mechanics of a *castell* and the reasons of its fall, this model would also provide initial data of the second problem to be studied, which would consist of understanding how and where the *castellers* of the *tronc* and the *pom de dalt* fall down once the structure of the *castell* has broken. This second problem would provide the map of the location of the falls onto the *pinya* for each type of the *castell*, which is the main objective of this project.

For more information on *castells*, see the web page of Coordinadora de Colles Castelleres de Catalunya [3] or also at Wikipedia [5], or also at [1] or [2] (in Catalan).

References

- [1] J. Roset, E. Cardús, E. Honorato, J.M. Saló, *Risc de lesió en els castellers a partir del càlcul de l'energia potencial* (in Catalan). Apunts Medicina de l'esport, 21-26 (1997).
- [2] *El risc dels castells* (in Catalan). Coordinadora de Colles Castelleres de Catalunya (2016).
- [3] Web page of Coordinadora de Colles Castelleres de Catalunya (in English): <http://www.cccc.cat/the-castells>.
- [4] Video of Human towers at UNESCO channel: <https://youtu.be/-iSHfrmGdyo>. From Departament de Cultura i Mitjans de Comunicació de la Generalitat de Catalunya (2009).
- [5] Wikipedia page for *castells* (in English): <https://en.wikipedia.org/wiki/Castell>.