



## Preservation and Usage: the Altar Machine in the Church Mother of Gangi (Palermo, Italy) and its Microclimate

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### Abstract

The aim of this study has been to find the correlation between delicate multimaterial artefacts, like painted wooden sculptures, and their microclimate. In particular the Altar Machine in the Church Mother of Gangi, a little town near Palermo (Italy), has been investigated. The Machine is constituted by carved and painted wood; a complex system of winch and pulleys allows to move some statues and parts of the Altar, in accordance with the baroque scenographic tradition.

The microclimate of the Machine has been monitored in order to verify if the thermo-hygrometric values fall within the safety intervals for wood and painted wooden sculptures, i.e. between 19 and 24 °C (temperature) and between 45 and 60 RH % (relative humidity) [1]. Analyses for the identification of wood species and for the study of painting materials have been also carried out. All images and data are accessible at the web site [www.dendrocronologia.org](http://www.dendrocronologia.org).

### Introduction

The first nucleus of the Church Mother in Gangi (Palermo, Italy) was built in the 14<sup>th</sup> century by Francesco I, Count of Ventimiglia. The Altar Machine inside, made of carved and painted wood, dates back to the second half of the 18<sup>th</sup> century. Moreover during some periods in the year some statues and parts of the Machine are moved by means of a complex system of winch and pulleys.

The aim of this research has been to study the correlations between the artefact and the microclimate in order to evaluate its state of preservation. The Italian Standard UNI 10829 [1] underlines the need of a long-term monitoring and of a statistical treatment of the data. The Machine is a particularly delicate structure, made of several materials as wood, pigments, binders, gilding: so the study and characterization of the constitutive elements have been also required.

A valuable reference for museum environments can be considered the so called safety thermo-hygrometric intervals [1]: for wood and painted wooden sculptures they have been set between 19 and 24 °C and between 45 and 60% RH. Daily temperature and moisture variations cause mechanical stress in wooden artefacts [2-3], often damaging the painted layers. Moreover, under specific conditions, they make wood susceptible to biotic degradation. Therefore a microclimate campaign has been useful to evaluate if the thermo-hygrometric parameters of the Machine environment were included or not within the safety intervals. In fact T and RH measurements and their variations may be considered chemometric parameters. Their elaboration allows to study the experimental data in order to evaluate the possible risks for the artifact.

### Materials & Methods

Temperature (T) and relative humidity (RH) values have been recorded by a digital data logger Testo 177-H1 model, equipped with sensors for T, RH and dew-point. The accuracy is  $\pm 0,5$  °C for T and  $\pm 3\%$  for RH. The instrument has been positioned near the altar machine in order to register the microclimate parameters of its environment. Parameters have been recorded every two hours from July 26 to September 8. Furthermore, wood humidity ( $U_1$ ) has been determined according to the hygrometric equilibrium method [3].

Identification of wood species has been also carried out following UNI 11118 standard [4]. Microsamples from the painted layers have been analyzed through a polarizing microscope Zeiss

Axioskop equipped with a Zeiss AxioCam and by FTIR spectroscopy, using a Nicolet Avatar 360 instrument operating in diffused reflectance modality.

Results on wood and paint layers analysis are accessible at the already mentioned web site.

## Results

The microclimate campaign has been carried out in summer, the most dangerous period for the artefact. In fact summer sultriness is particularly high during August. Moreover, in August the Machine is moved on the occasion of religious celebrations and believers crowd into the church, influencing the microclimate.

Taking into account the safety T-RH intervals, the related diagram is here reported (fig. 1) [5].  $P_i$  represents the Performance Index, that is the set % of T and RH data falling within the safety intervals (s.i.), while  $F_i$  is the failure index, the % of T and RH values falling outside the s. i..

In general it is possible to assess that most of the data (T-RH couples) fall outside the s. i. and only 5,30% is within the same. It is interesting to note that most of the data (65,7%) fall within the safety RH interval, whereas T values result very often too high.

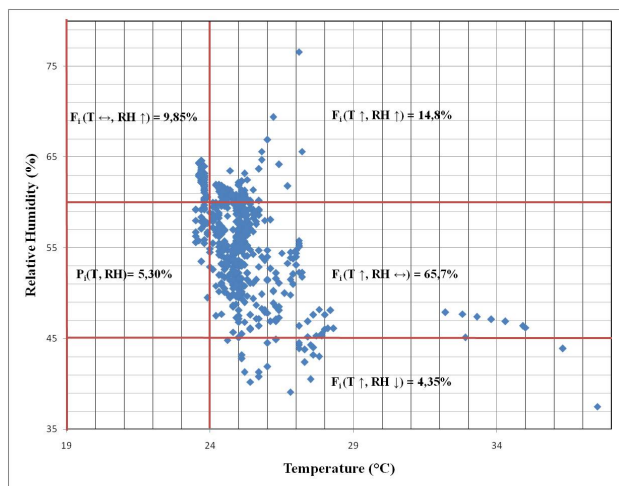


Fig. 1: T and RH performances;  $P_i$  and  $F_i$  in the safety diagram [5].

implemented with measurements to be done during the other seasons in order to suggest provisions ameliorating the artefact conservation.

## References

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- 4) UNI, Cultural heritage - Wooden artefacts - Criteria for the identification of the wood species, *Italian Standard UNI 11118*, (2004)
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High values of temperature can favour the microbiological attack (fungi and xylophagous insects). Furthermore, graphs of T and RH versus time (data not reported here) have shown that T values were in general too high (out of the s. i.), but they appeared quite constant; on the contrary RH values fell almost always inside the s. i., but they often exhibited dangerous variations.

## Conclusions

We can underline the following results:

- 1 – the microclimate of the Altar Machine exhibits characteristics dangerous for the artifact;
- 2 – the adopted methodology has been useful to define the trend of the T-RH parameters;
- 3 – the experimental data have to be