

# “War-scapes testimonial gradient”: a multi-criteria approach as a proactive tool for choosing future practices of enhancement

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**Abstract** – The vastness of the material permanences of the Great War within contemporary landscapes imposes on the stakeholders that want to take care of them the need to identify new operational tools capable to calibrate a map of intervention priorities. This contribution presents the elaboration of a methodological approach capable of dealing with the complexity of this fragile heritage through a knowledge-based skeleton useful for comparing different territorial areas by assigning them different "testimonial gradients" with respect to the level of knowledge of specific pre-established indicators. Thanks to a multi-criteria analysis matrix based on analytical-hierarchical processes (AHP) weights and quantities are assigned to the indicators and sub-indicators under analysis thus highlighting, for each analyzed area potentialities and criticalities that become indispensable for planning future enhancement interventions. This paper presents the application of this innovative approach on the permanences of three fortified systems on the Vezzena Plateau in Trentino (Italy), along what, a hundred years ago, was the former first border line between Italy and the Austro-Hungarian Empire. This study case was sponsored by the Superintendency of the Autonomous Province of Trento that needed an analytical tool to identify on which of these three areas, currently in a state of neglect and degradation, to program future conservation and enhancement plans.

## I. INTRODUCTION

The militarization processes linked to the Great War radically transformed European landscapes with the construction of a complex and heterogeneous palimpsest of permanent and field works that even today, after more than a hundred years, persist in contemporary landscapes at different degrees of visibility, very often as isolated fragments. The dynamics of post-conflict transformation, processes of slow degradation and abandonment, as well as uncontrolled anthropic actions that do not respect the authentic character of these "remains," pose a threat to all these vestigia concerning which there has been

progressively increasing concern about the risk of dispersal: a risk corresponding to the potential loss of the "possibilities of memory" that such material traces can precisely stimulate. In addition to this, the vastness of such cultural heritage imposes the necessary research and the development of new methodological tools capable of defining some knowledge-based parameters through which understand main criticalities and, therefore, allow one to calibrate a sort of map of intervention priorities, with respect to which select the most "at risk" contexts that require more urgent interventions.

In response to these questions, this contribution presents the development of a novel method for military archaeology, that overcomes the conservation/innovation dichotomy, typical of preservation practices, through a knowledge-based approach capable of addressing the complexity and fragmentation of this fragile cultural heritage without reducing its cultural potential. It is an approach that allows, at the landscape scale, the recognition of what may have memorial value and, in this way, it can assign values of "testimonial gradients" to the different territorial areas, i.e., testimonial values graduated to the variability of the cultural capital of the different elements that make up the "war landscapes" [1,2,3]. The function's variables are described according to the level of knowledge of specific predetermined indicators, such as historical-identity aspects, typological-constructive knowledge of the artefacts, the degree of community involvement and, above all, the legibility of the vestigia system. From an operational point of view, this is made possible by setting up a multi-criteria analysis based on Analytical-Hierarchical Processes (AHP) that, by assigning precise weights and quantities to the indicators and sub-indicators under analysis, can compare, simultaneously, the areas under study highlighting their different "testimonial gradients," potentialities and criticalities [4].

This approach is very useful in policies related to spatial planning and cultural heritage management and enhancement as it offers a significant proactive contribution in decision-making practices related to the identification of territorial areas on which to prioritize

investing means and resources for their regeneration and "minor" tourism development [5].

Applying this methodological approach, the permanences of three different fortified systems, insisting in the surroundings of as many permanent fortifications (Fort Campo Luserna, Fort Verle and Fort Cima Vezzena) and located on the Vezzena Plateau in the province of Trento (Italy), along what was the front line on the border between Italy and the Austro-Hungarian Empire in 1915, were analyzed and compared. This case study was identified as a result of a direct request from the Superintendency of the Autonomous Province of Trento, that needed an analytical tool to identify on which of these three areas, currently in a state of abandonment and degradation, it was optimal to prioritize future conservation and enhancement plans to avoid their loss and, at the same time, to relaunch local development with new tourist and cultural circuits.

## II. STUDY AREA

The study case is located on the Vezzena Plateau in Trentino, Italy, and specifically includes the fortified system formed by the Austro-Hungarian forts Campo Luserna (Luserna Werk), Fort Busa Verle and Fort Vezzena (Spitz Verle Werk) (Fig.1).

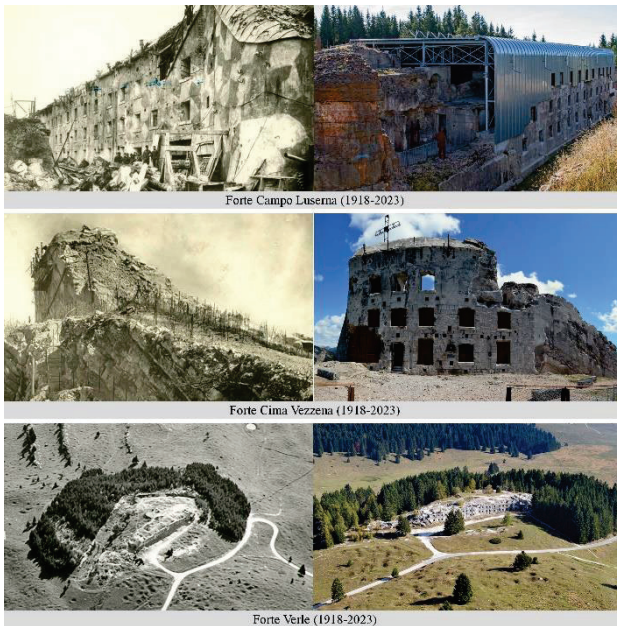


Fig. 1. Study area: Forte Campo Luserna, Forte Cima Vezzena, Forte Verle (historical pics VS current state)

These permanent works belong to the "Fourth Generation" of fortifications built by the Austro-Hungarian Empire, essentially corresponding to the "Armored Forts," made of special concrete with different types of iron reinforcement and protective armour. Nowadays these "war landscapes" are universally recognized as "historical places of memory" as they were the scene of bitter bombardment in 1915, in the aftermath of Italy's entry into the war, since,

precisely the front on the Vezzena Plateau was the focus of the first very harsh phase of the conflict. Numerous historical sources testify the enormous impact of the First World Conflict on the area whose landscape was completely transformed by the construction of forts, trenches, barracks and artillery emplacements and by the bursting of several thousand explosive charges. After more than a century, the material permanences of the conflict persist in this landscape at different levels of recognizability: if the permanent works are perfectly recognizable and some of them (Fort Campo Luserna and Fort Vezzena) have also been interested in recovery/restoration interventions, the "material traces" related to both the field and temporary fortifications (entrenchments, shelters, firing positions, caves) and the "signs of destruction" are not equally identifiable and are at various stages of post-depositional and post-disposal processes, implying an increasing loss of information potential. Thus, the need to identify the areas potentially most "at risk of loss," and thus in need of priority safeguarding interventions, becomes evident.

## III. METHODOLOGY

Multi-criteria analysis is based on a scale of values used to compare different alternatives based on different indicators and parameters, considering the relative importance related to each of them. In this analysis, decision criteria are expressed and, then, compared based on a weight defined through value analysis. The first step, to be developed through discussion with the stakeholders and decision-makers of the interventions to be implemented (Entities, Associations, Funders, Foundations), concerns the definition of the  $I_{1-n}$  indicators and their descriptive sub-parameters to which the relevant "weighting factors" ( $W_f$ ) are then attributed in such a way that the total of the values of the sub-criteria corresponds to the "weight" of the indicator to which they refer, while the sum of the different indicators corresponds to unity [6]. With the participation of public stakeholders such as the provincial Superintendency, Valley Communities, municipalities, local museums and libraries, schools and universities, -aslocal communities, through meetings and gatherings, it was possible to identify 4 main indicators, useful for understanding the semantic density of these places. These are the historical-anthropological components that define the historical biography of these wartime landscapes (with  $W_f = 0.2$ ); the parameters that enable us to understand the level of visibility and recognizability of war-related "tangible signs" within the contemporary landscape ( $W_f = 0.3$ ); the aspects more specifically related to the typological and technological scope of the works built within them, with the related innovations and experiments ( $W_f = 0.25$ ); and, finally, the management and governance modalities of this set of works, concerning the development and revitalization perspectives that can be triggered and reverberate from

them at different scales ( $W_f = 0.2$ ).

One of the strengths of this approach is the deep participatory component of different stakeholders at every stage of the process: this fully reverberates the principles contained in the Faro Convention, a Council of Europe Framework Convention on the Value of Cultural Heritage for Society, signed in 2005 but ratified, in Italy, only in September 2020. Essentially, the Convention emphasizes the value and potential of cultural heritage as a resource for sustainable development and quality of life and identifies the "right to cultural heritage," recognizing, at the same time, individual and collective responsibility for the heritage itself, that must take the form of active and synergistic participation of all stakeholders.

In this perspective, therefore, after specifying each indicator with a set of sub-criteria  $\beta$  ( $\beta = a \dots v$ ) as shown in Fig.2, the different stakeholders were asked to express their judgment, for each area under analysis, assigning to each sub-criterion a relative value based on the degree of satisfaction of the sub-criterion itself (total satisfaction will correspond to the maximum value indicated for each sub-criterion). Finally, using the arithmetic averages of these reference values, it was possible to construct, for each of the sub-criteria, a true analytical evaluation matrix, comparing the different spatial areas (Area 1 - Area n) being compared on the basis of the principles of value analysis and fuzzy logic [7]. Taking two areas at a time, indeed, it was possible to calculate the ratio between the averages of the respective weighting coefficients, thus obtaining, for each area, values that were not absolute but calibrated according to the other areas under consideration ( $p_{x,y}$ ).

$$p_{1,2} = \frac{(w_F)_1}{(w_F)_2} \quad (1)$$

Defined the ratio of the "total relative weight"  $\sum_{x,y=1}^n p_{x,y}$  of a single sub-criterion  $\beta$  for a specific area x and the sum  $S = \sum_{k=1}^n \sum_{y=1}^n p_{k,y}$  of the weights of that same criterion  $\beta$  for all areas, it was possible to calculate a Comparison Index  $IC_{\beta,x}$  (con  $x=1-n$ ) that multiplied by the maximum  $W_f$  associated with that parameter returned the value of the "share"  $v_{\beta,x}$  of that descriptor for each specific area, graded in relation to the values of the same parameter in the other n areas. Regarding area 1, for example:

$$IC_{\beta,1} = \frac{\sum_{y=1}^n p_{1,y}}{S} \quad (2)$$

$$v_{\beta,1} = IC_{\beta,1} * (w_F)_{\beta max} \quad (3)$$

Finally, summing the values of the sub-criteria thus derived yielded the weight of the indicator in question  $I_i$  (with  $i=1-4$ ), while the sum of the four indicators of a specific x area makes it possible to define the actual "testimonial gradient"  $\nabla$  of that area under analysis.

$$\nabla \text{ testimonial gradient} = \sum_{i=1}^4 I_i \quad (4)$$

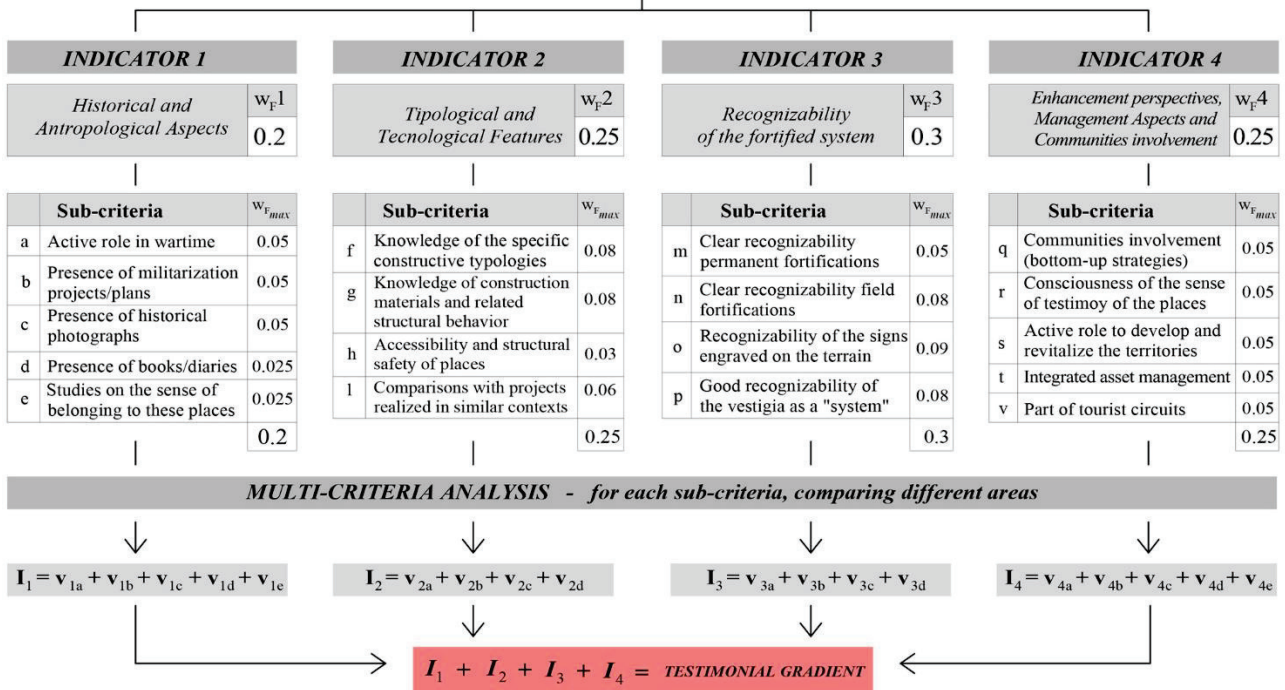
#### IV. RESULTS

Applying this methodology to the study case, we found numerical parameters for each fortified system to all the sub-criteria previously described, with the information found during the data acquisition phases involving stakeholders (Fig.2). With these values, summary matrices were elaborated for each sub-criterion to derive the different "weighting factors" concerning the four indicators (Fig.3). Summing the weighting factors, the values concerning the "Knowledge Indicators" referring to each areas under analysis were obtained (by way of example, Fig.3 shows the precise calculation of Indicator 2). Finally, by adding up the four indicators it was possible to define the specific value of the "testimonial gradient" associated with the three different fortified areas. The highest gradient was found to be in the area around Fort Campo Luserna (value of 0.38), while the lowest gradient referred to the fortified system insisting on Fort Verle (value of 0.24); the area of Fort Vezzena, on the other hand, is in an intermediate position with a value of 0.28 (Fig.3). The overall results can be validated to a certain extent also considering that Forte Campo Luserna has been restored with an important project promoted within the Trentino project "Great War", and since 2014 has become an integrated part of museum tours, as well as a place of tourist attraction in which musical and theatrical outdoor events are often organized. These aspects increase the 4th indicator, is much higher than that of the other two fortified areas. Even Forte Cima Vezzena has been the subject of an intervention to secure the works to make the area accessible, since the high landscape value of the context has always made the strong destination of important hiking and tourist circuits (Pizzo di Levico). It is precisely these reasons that increase, also in this case, the Indicator 4, and consequently also the overall "testimonial gradient", for example, compared to strong Busa Verle. As for the other aspects, the two fortified systems are not very dissimilar as indicated by Indicators 2 and 3: both fortifications have similar potential/ criticality concerning both the technological aspects-constructive that the issues regarding the very recognizability of warscape as a "system". Anyway, as far as Indicator 1 is concerned, the primacy is surely recognized in Forte Busa Verle, because the bombing of this work began the Italian-Austrian war. As already mentioned, the great potential of these analyses is not only to have identified the values related to the "testimonial gradients" of the different fortified areas, important to understand how to set a different "design margin" for future memory practices in these areas, but is the main way to understand on which directions direct precisely these future practices to safeguard this heritage.



## STAKEHOLDERS' INVOLVEMENT: VALUES' ASSIGNMENT

### TESTIMONIAL GRADIENTS



## STAKEHOLDERS' INVOLVEMENT: VALUES' ASSIGNMENT

		Verle Fort	Vezena Fort	Campo Luserna Fort
<b>Indicator 1</b>				
Sub-Criteria		Wf		Wfmax
a	Active role in wartime	0,05	0,02	0,05
b	Presence of militarization projects/plans	0,05	0,03	0,05
c	Presence of historical photographs	0,05	0,02	0,05
d	Existence of books/diaries	0,01	0,01	0,02
e	Studies on the sense of belonging to these places	0,005	0,01	0,015
		<b>0,165</b>	<b>0,09</b>	<b>0,185</b>
<b>Indicator 2</b>				
Sub-Criteria		Wf		Wfmax
f	Knowledge of the specific constructive typologies	0,07	0,06	0,08
g	Knowledge of construction materials and related structural behavior	0,04	0,06	0,08
h	Accessibility and structural safety of places	0,01	0,01	0,015
l	Comparison with projects carried out in similar contexts	0,03	0,04	0,04
		<b>0,15</b>	<b>0,17</b>	<b>0,175</b>
<b>Indicator 3</b>				
Sub-Criteria		Wf		Wfmax
m	Clear recognizability permanent fortifications	0,05	0,05	0,05
n	Clear recognizability temporary and field fortifications	0,03	0,06	0,08
o	Good recognizability of the signs engraved on the terrain	0,03	0,03	0,06
p	Good recognizability of the vestigia as a "system"	0,03	0,06	0,08
		<b>0,14</b>	<b>0,2</b>	<b>0,3</b>
<b>Indicator 4</b>				
Sub-Criteria		Wf		Wfmax
q	Communities involvement (bottom-up strategies)	0,01	0,03	0,04
r	Consciousness of the sense of testimony of the places	0,04	0,03	0,04
s	Active role to develop and revitalize the territories	0,03	0,04	0,04
t	Integrated asset management	0,01	0,03	0,04
u	Part of tourist circuits and museums (local induces)	0,01	0,03	0,05
		<b>0,1</b>	<b>0,16</b>	<b>0,21</b>

Fig. 2. Testimonial gradients: above, definition of indicators and sub-criteria; below, application of the stakeholders' involvement for the values' assignment to the case study of the Vezena Plateau (TN-Italy)

**MULTI-CRITERIA ANALYSIS**  
 to develop for each Sub-criteria  $\beta$ , comparing n different areas

Sub-criteria $\beta$ con $\beta = a...v$	Area 1	Area 2	Area 3	...	Area n	$\sum_{x,y=1}^n p_{x,y}$	$IC_{\beta,x}$ (con $x = 1...n$ )	$V_{\beta,x}$ (con $x = 1...n$ )
Area 1	$p_{1,1}$	$p_{1,2}$	$p_{1,3}$	...	$p_{1,n}$	$\sum p_{1,1...n}$	$\frac{\sum p_{1,1...n}}{S} = IC_{\beta,1}$	$IC_{\beta,1} \times W_{F \max} = V_{\beta,1}$
Area 2	$p_{2,1}$	$p_{2,2}$	$p_{2,3}$	...	$p_{2,n}$	$\sum p_{2,1...n}$	$\frac{\sum p_{2,1...n}}{S} = IC_{\beta,2}$	$IC_{\beta,2} \times W_{F \max} = V_{\beta,2}$
Area 3	$p_{3,1}$	$p_{3,2}$	$p_{3,3}$	...	$p_{3,n}$	$\sum p_{3,1...n}$	$\frac{\sum p_{3,1...n}}{S} = IC_{\beta,3}$	$IC_{\beta,3} \times W_{F \max} = V_{\beta,3}$
...	...	...	...	...	...	...	...	...
Area n	$p_{n,1}$	$p_{n,2}$	$p_{n,3}$	...	$p_{n,n}$	$\sum p_{n,1...n}$	$\frac{\sum p_{n,1...n}}{S} = IC_{\beta,n}$	$IC_{\beta,n} \times W_{F \max} = V_{\beta,n}$
						$S = (\sum p)_{1...n}$		

$I_{i,x} = \sum V_{\beta,x}$   
 $x = 1...n$  n areas under analysis  
 $a, b, c...v$  sub-criteria (see fig. 2)  
 $i = 1$  INDICATOR 1 if  $a < \beta < e$   
 $i = 1$  INDICATOR 2 if  $f < \beta < l$   
 $i = 1$  INDICATOR 3 if  $m < \beta < p$   
 $i = 1$  INDICATOR 4 if  $q < \beta < v$   
 $I_1 + I_2 + I_3 + I_4 = \text{TESTIMONIAL GRADIENT}$

**EXAMPLE CALCULATION of multi-criteria analysis for Indicator 2 (same method applied for the calculation of the other indicators)**

	Forte Vezzena	Forte Verle	Forte Campo Luserna	$\sum p_{xy}$	$IC_{\beta,x} = (\sum p_{xy})/S$	$V_{\beta,x} = (IC_{\beta,x}) * W_{fmax}$
<b>f</b> $W_{fmax} = 0,08$						
Forte Vezzena	1,00	0,86	1,00	2,86	0,32	<b>0,02</b>
Forte Verle	1,17	1,00	1,17	3,33	0,37	<b>0,02</b>
Forte Campo Luserna	1,00	0,86	1,00	2,86	0,32	<b>0,02</b>
			<b>S=</b>	<b>9,05</b>		
<b>g</b> $W_{fmax} = 0,08$						
Forte Vezzena	1,00	1,50	1,00	3,50	0,38	<b>0,02</b>
Forte Verle	0,67	1,00	0,67	2,33	0,25	<b>0,01</b>
Forte Campo Luserna	1,00	1,50	1,00	3,50	0,38	<b>0,02</b>
			<b>S=</b>	<b>9,33</b>		
<b>h</b> $W_{fmax} = 0,03$						
Forte Vezzena	1,00	1,00	0,67	2,67	0,29	<b>0,01</b>
Forte Verle	1,00	1,00	0,67	2,67	0,29	<b>0,01</b>
Forte Campo Luserna	1,50	1,50	1,00	4,00	0,43	<b>0,02</b>
			<b>S=</b>	<b>9,33</b>		
<b>i</b> $W_{fmax} = 0,06$						
Forte Vezzena	1,00	1,33	1,00	3,33	0,36	<b>0,02</b>
Forte Verle	0,75	1,00	0,75	2,50	0,27	<b>0,01</b>
Forte Campo Luserna	1,00	1,33	1,00	3,33	0,36	<b>0,02</b>
			<b>S=</b>	<b>9,17</b>		

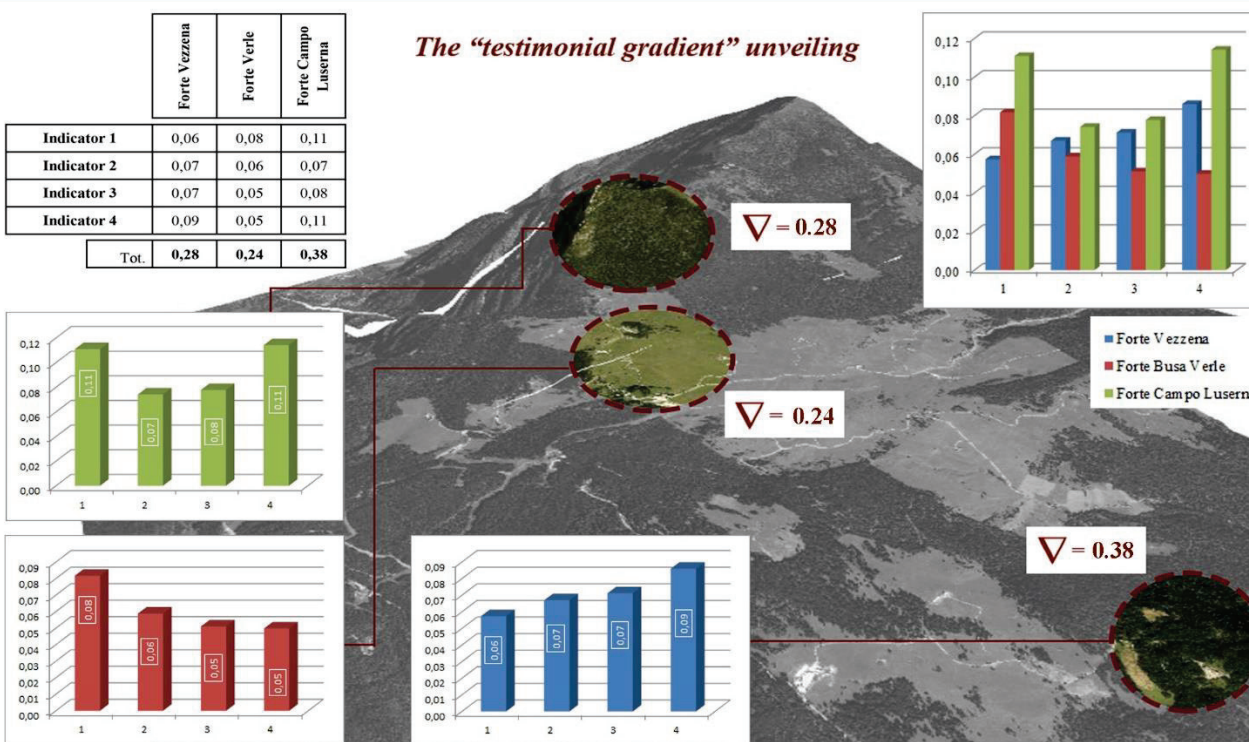


Fig. 3. Above, definition of the multi-criterial matrix of analysis and calculation example for Indicator 2; below, application of this analysis to the study-area (Vezzena Plateau-TN-Italy) and unveiling of the "testimonial gradient".

The tables (Fig.3) show that the "weaknesses" on which focus future attention coincide precisely with the "lower values" of the different indicators: for example, a possible and coherent strategy of valorization of this warscape should invest precisely in the insistent area on Forte Busa Verle because, in the face of a high historical-memorial potential (Indicator 1), the aspects related to the construction technique (Indicator 2) and the recognition of the "signs in the landscape" (Indicator 3) allow for a wide margin of "improvement and strengthening", the "enhancement" of which can also increase the management, maintenance and participation aspects (Indicator 4).

### CONCLUSIONS

The identification of spatial areas with different testimonial gradients not only returns a mapping of the semantic density of a given warscape but also defines a sort of "map of risk and fragility", in which risk is meant precisely the "risk of loss" of the cultural and memorial potential of these important contexts, i.e. when the indicators identified return a lower semantic intensity of both their physical-material components ("signed matter"), as well as intangible ones (value-memorial charge). The four "knowledge-based indicators" are complementary aspects that, precisely as a whole and thanks to the interrelations that are generated between them, allow one not only to bring out the areas with similar peculiarities but also to highlight the "weaknesses" and critical issues, to be improved and strengthened with the objectives that one wants to pursue in the future. In other words, future enhancement practices will have to pay particular attention especially to those areas where the semantic significance is not clearly evident and recognizable, i.e. areas with a high but latent, still waiting to be unveiled and improved, "testimonial gradient".

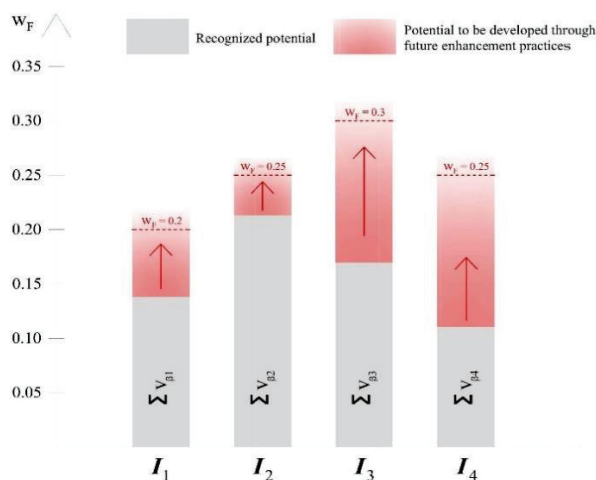


Fig. 4. Indicators, weighting coefficients and associated room for improvement in the multicriteria analysis

At the operational level, it is a matter of metaphorically

reinterpreting "in negative" the multicriteria analysis previously carried out for the identification of the different "gradients" (grey parts in Fig.4), that is, trying to develop projects able to increase the weighting coefficients of the different indicators until reaching their maximum value (part in red in Fig.4) [8,9].

The setting of this multicriteria analysis represents the right balance between knowledge and practice, or a new analytical tool to use to compare different "war landscapes", but in general "different cultural heritage", not only to consciously set future enhancement scenarios, but also to identify the main criticalities in relation to the objectives, and consequently to be able to calibrate a sort of map of priorities of intervention, with respect to which to select the most "at risk" requiring more urgent treatment.

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