

Development of a methodology to study typicity of PDO wines with professionals of the wine sector

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Abstract

BACKGROUND: Today, many agricultural products claiming a link to their origin and typicity receive a warm welcome on the market. Nevertheless, the notion of typicity is blurred for consumers and needs to be objectified for communication purposes. This study aims at formalizing a methodology for studying typicity of terroirs, with PDO wines as an example, using a participatory approach with professionals of the wine sector from terroirs, using focus group and tasting. The vision of typicity of terroirs by professionals outside of these terroirs has been studied by a free word association task.

RESULTS: This study allowed a clear distinguishing of the typicity of the studied terroirs. Professionals from terroirs identified the global conceptual typicity of their terroirs using various factors, mainly soil, geography and grape variety, whereas professionals outside terroirs expressed their visions of terroirs by reputation or sensory characteristics of wines. Tasting results showed a discrimination of wines based on their typicity and highlighted descriptors involved in sensory perceptual typicity for each studied terroir.

CONCLUSIONS: Professionals from terroirs share a common vision of their typicity and identify more typicity factors than professionals outside terroirs. Sensory typicity has been highlighted for five of the six terroirs studied, according to the various descriptors. The study of two populations, from and outside terroirs, shows the gap between the typicities identified by professionals from terroirs and those perceived by professionals outside terroirs.

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Keywords: sensory analysis; focus group; free word association task; exemplarity; just-about-right profile

INTRODUCTION

Today, consumers around the world are increasingly demanding 'local' or 'terroir' products.^{1–3} In response to this demand, many agricultural products, notably wines, claim a typicity and a link to their original terroir.^{4–6} In Europe, the recognition of terroir and typicity has been framed by geographical indications (GIs): protected geographical indication or protected designation of origin (PDO).⁷ GIs are defined as 'a sign used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin'.⁸ The trend for typical products is also similar outside Europe as in the USA,⁵ Australia⁶ or Chile⁹ where producers also claim the specificities of their terroirs and work for their recognition. The GI labels guarantee specific characteristics in the product but these characteristics have to be identified and validated based on terroir characteristics, called typicity.

For vitiviniculture, the OIV (International Organization of Vine and Wine) defines the terroir as 'a concept which refers to an area in which collective knowledge of the interactions between the identifiable physical and biological environment and applied vitivinicultural practices develops, providing distinctive characteristics for the products originating from this area'.¹⁰ The terroir concept is based on characteristics such as specific soil, topography, climate, landscape characteristics and biodiversity features.¹⁰

In relation to this definition, the typicity concretizes the effect of the terroir by regrouping characteristics distinguished and identified by a human reference group (HRG)¹¹. This group has the capability of evaluating if a product belongs to the identified type or if it is overly different.¹¹ This HRG is composed of different stakeholders including wine producers, wine merchants, regulatory actors (unions) or even well-informed consumers.¹¹

Typicity is divided into a conceptual part and a perceptual part.¹² Conceptual typicity refers to the image and characteristics of the typical product shared by members of the HRG. It includes global factors such as history, geography, soil, climate, varieties, practices and production processes at the terroir level, and also

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organoleptic factors that the wines from the area should have (appearance, aromas, flavors, body, tannins or acidity, etc.).¹²

Sensory perceptual typicity is evaluated during tasting and is thus the adequacy between perceived characteristics of a product and the sensory conceptual typicity of that product memorized and shared by the HRG^{12,13} (Fig. 1). During tasting, tasters mobilize the sensory conceptual typicity that they have in mind in order to evaluate the perceptual sensory typicity of the products.¹⁴

In this context, more and more studies focus on typicity of existing GIs^{9,15–19} and methodologies are proposed for assessing wine typicity. Sensory perceptual typicity is generally assessed through an exemplarity measurement on a linear scale from ‘bad example’ to ‘good example’, developed by Ballester *et al.*²⁰ and used by many authors to study typicity of PDO wines.^{21–23} This exemplarity rating can be associated with different descriptive profiles to highlight the sensory characteristics responsible for the perceptual typicity. Just-about-right (JAR) scales (‘not intense enough’ on the left, ‘too intense’ on the right and ‘ideal’ in the center) allow evaluation of the intensity of descriptors in comparison with the ideal type.¹² Rating on JAR scales, often used for consumer preferences, seems appropriate in typicity studies because this concept can be considered as a hedonic representation, with an optimum for each judge.²⁴ However, evaluators, at the risk of biasing the rating, must not mistake hedonism or quality and typicity.^{25,26}

Cadot’s studies¹² demonstrated the relevance of using combined sensory analysis techniques (exemplarity measures, QDA[®] descriptive profile and JAR scales) to validate product group segmentation. To date, these methods have been used to study one or two wine PDOs, but their effectiveness on a larger scale or for more complex sample sets with comparisons is questionable.

In general, whatever the sensory descriptive method used, the selection of the descriptors is an important issue since they should be representative of the sensory conceptual typicity. They can be chosen *a priori* but also generated by members of the HRG, in order to list the most representative terms of the studied product typicity.¹² In most of the studies concerning this subject, when pre-defined lists are used, they are rarely built on a consensus between professionals, but often according to individual interviews.¹²

However, some technics exist for studying group dynamics, consensus or disagreement about different subjects. Focus groups are qualitative semi-directive group interviews, based on

‘group dynamics’,²⁷ and are often used in a participatory approach, to guide a debate and to highlight points shared by interviewees.²⁷ Other exercises allow observation of the vision of a population sample on a studied object, such as the free word association task (FWAT), to study conceptual structures and attitudes in psychology and sociology.²⁸ During the FWAT, ideas are spontaneously quoted.²⁹ According to Dean *et al.*,³⁰ a word association task is useful for clarifying the affective elements linked to the studied concepts. Moreover, this method is rapid¹³ and easy to use for interviewees. During the last decade, this method has been increasingly used in sensory and consumer sciences^{31–35} but never in the case of typicity evaluation.

Even if today typicity is defined and some methods are known for exploring sensory typicity,²¹ studies of conceptual typicity performed with HRG members as a group and not individually are still lacking. The study presented here aimed to determine how a participative approach with terroir HRGs could contribute to the study of conceptual and perceptual typicity notably based on a consensual typicity descriptor list. In addition, the study considered the added value of interviewing professionals outside terroir HRGs.

MATERIALS AND METHODS

Case study

The study was carried out on a large vineyard area in southern France: the Languedoc (263 000 ha in 2016).³⁶ The aims of the study were explained to the various terroir unions (regulatory actors) that had decided to participate. To participate, terroirs had to meet a few criteria: non-overlapping production areas between them, different soils and their ability to provide wines for tasting. Six terroirs of red wine from Languedoc were studied (denoted from A to F). All of these terroirs either have PDO status or their recognition is ongoing. At the same time they differ in some factors such as soil, climate or varieties (Table 1). For each of the terroirs studied, terroir unions were asked to select 10 ‘cuvées’, representative of their typicity for the 2016 vintage.

Participants of the study

This study focused on wine sector professionals. All the interviewees were winemakers, producers, enologists, merchants, wine merchants, sommeliers, staff of unions, etc.

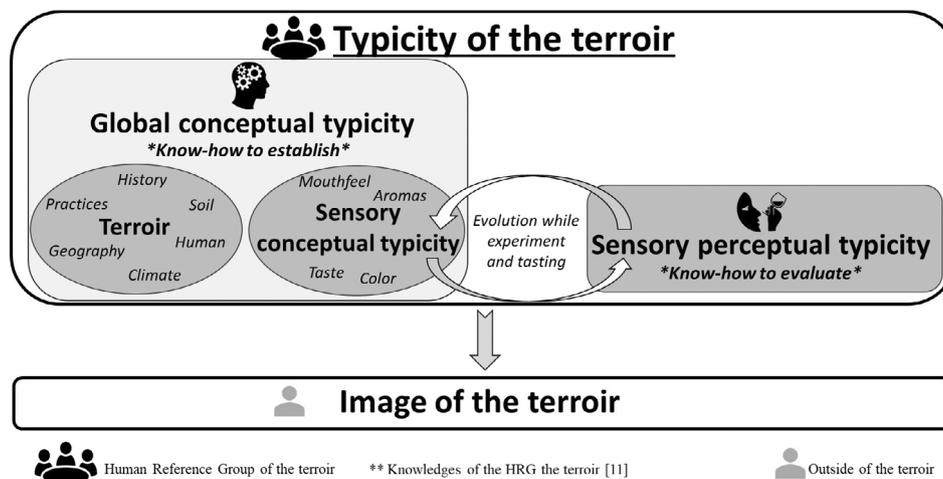


Figure 1 Scheme of conceptual and perceptual typicity.

Table 1 Characteristics of the studied terroirs

	A	B	C	D	E	F
Status	PDO	PDO	PDO	Ongoing recognition	PDO	PDO
Soil	Clay–limestone	Limestone	Schist	Limestone and marlstone	Limestone	Limestone and sedimentary
Climate	Mediterranean, hot and dry with wind	Mediterranean, maritime influence	Mediterranean, mountain influence	Mediterranean, very hot and sunny	Mediterranean, hot and dry with wind	Continental, rainy and large thermal range
Principal varieties	Grenache N, Mourvèdre N	Grenache N, Mourvèdre N, Syrah N	Grenache N, Lledoner pelut N, Mourvèdre N, Syrah N	Grenache N	Grenache N, Mourvèdre N, Syrah N	Grenache N, Mourvèdre N, Syrah N
Other varieties	Carignan N, Syrah N	Carignan N, Cinsault N	Carignan N, Cinsault N	Carignan N, Mourvèdre N, Syrah N, Lledonner pelut N	Carignan N, Cinsault N	Carignan N, Cinsault N, Counoise N, Morrastel N
Yield (max.) (hL ha ⁻¹)	45	42	45	40	42	50

The study was carried out with two different populations: HRGs of each studied terroir and professionals of the wine sector outside these HRGs. Table 2 summarizes the number of participants and their characteristics such as gender, age and profession for each group.

Professionals from each terroir HRG were contacted by their union to participate in the study. For professionals outside HRGs (Languedoc and outside Languedoc), an online questionnaire was sent to more than 600 professionals of the wine sector among the winemaking regions in France, out of the studied terroirs. A total of 420 answers were collected: 206 outside the Languedoc region and 214 within the Languedoc region. Also, members of HRGs were interviewed during focus group about terroirs in which they do not work and these answers were compiled as answers of professionals outside the HRG but within the studied area (Languedoc). For example, a producer from Terroir A answered about Terroirs B, C, D, E and F as a professional outside the HRGs of these terroirs, but from within the Languedoc, during the focus group of Terroir A.

Construction of methodology

In order to study conceptual (global and sensory) and sensory perceptual typicity, several methods were combined and used for different panels (Fig. 2). HRG members of each terroir were interviewed during six focus groups.²⁷ During these focus groups, global conceptual typicity, linked to the terroir, and a focus on sensory conceptual typicity of wines were discussed before a tasting. This blind tasting comprised wines from the terroir and from others. Professionals outside of the HRGs performed a FWAT^{31–35} about the six studied terroirs.

Study of conceptual typicity of terroirs and wines: focus group with HRGs

Six focus groups were organized with the different HRGs, one for each studied terroir. Characteristics of the groups are presented in Table 2.

The focus groups started with a FWAT to get participants individually to consider the theme. Participants had to write three words for each terroir, according to his/her idea of its typicity. Then, a debate was initiated to reach a consensus about global conceptual typicity factors (history, geography, soil, climate,

production process, etc.) of the HRG terroir. The focus groups were audio recorded and fully transcribed (discourses and attitudes of each participant).

For sensory conceptual typicity, each participant wrote the characteristics they considered as typical of red wines from their own terroir on a piece of paper. During instructions, it was specified that hedonic terms would not be retained in order to limit bias. Then, the papers were displayed on a paperboard and a debate was initiated about the generated terms.

Then, members of HRGs, according to their consensus, reduced the list to reach the most important characteristics of typicity. This step was also the opportunity to explain complex terms such as 'balanced' or 'minerality', in order to find a consensual definition for the participants.

Study of sensory perceptual typicity of wines: exemplarity rating and JAR profile by HRGs

Tasting was carried out by the participants of focus groups, just after the selection of typicity descriptors. For these tastings, 10 wines from the tested terroir were presented as well as four wines from other studied terroirs, called outsiders (OUT). The four OUT wines were wines taking part of the study, and were presented during each tasting. They were considered as globally different from the other wines during a blind tasting by five professionals of the sensory laboratory, upstream of the study. Wines were presented in black glasses according to a Latin square plan of Williams³⁷ in order to limit the order effect and the carry-over effect. Wines were served at room temperature with a plastic cup over glasses in order to keep aromas. Tasters were invited to rinse their mouths before the first sample and then between each sample, in order to limit the impact of residual flavors.

For each sample, tasters first answered the exemplarity rating, using a linear scale from 'bad example' to 'good example' of their terroir. Then, they answered the JAR profile for all the descriptors previously selected by the HRG for their terroir. This profile was presented on linear scales for each descriptor from 'not enough' on the left, through 'just about right' in the center to 'too much' on the right.

For analysis, the exemplarity rating of each judge was converted into a score from 0 (bad example) to 10 (good example). A two-way ANOVA (judges, products) at the 10% confidence level was

Table 2 Number and characteristics of participants per group

Terroir	HRGs of each terroir					
	A	B	C	D	E	F
Number of participants	214	7	9	7	15	44
Average age (min.–max.)	45 (19–68)	41	42	44	44	44
Women/men (%)	36/64	33/67	44/56	47/53	47/53	47/53
Professions (number)	Outside of Languedoc Sales (64), production (50), research and students (11)	Winemakers (4), enologists (3), commercial (1)	Winemakers (4), enologists (2), vineyard chef (1)	Winemakers (4), enologists (3), commercial (1) union representative (1)	Winemakers (5), enologist (1), union representative (1)	Winemakers (8), enologists (3), director (1) union representatives (3)
Years of work on the PDO	—	From 1 to more than 35	From 1 to more than 20	From 1 to more than 30	From 10 to more than 30	From 1 to more than 20

performed on the exemplarity rating to determine whether differences were perceived between the products. If so, a difference test (Fisher LSD) showed which products have been discriminated according to their exemplarity. Means of exemplarity rating for each terroir and Fisher LSD comparison test allowed identification of 'good examples' and 'bad examples' samples.

For JAR profiles, rating was converted into a score from 0 to 10. Data were analyzed product by product by penalty analysis. For a more global analysis, scores were converted into three terminals, as on the JAR scale: 'not intense enough' scores under 4, 'too intense' scores over 6 and 'ideal' scores between 4 and 6.¹² A contingency table was built on the frequency of each terminal for each product and for each descriptor. A factorial correspondence analysis (FCA) was then performed on this table to observe the position of each product according to descriptor categories.

Study of images of terroirs outside of HRGs: FWAT

Concerning interviewees who did not participate in focus groups, professionals outside HRGs, they completed FWATs in online questionnaires. Firstly, the objectives of the study were explained: 'This project focuses on the vision of professionals from wine sector about different terroirs. This questionnaire is about red wines from different terroirs of Languedoc region'. Then, the instruction: 'For each terroir, please list the first three words coming to your mind spontaneously'.

Regarding the analysis, the first step was to recode all the vocabulary generated. Every word was recoded in order to have the same spelling for the same idea, called synonyms (for example: sun, sunny, quite sunny = 'sun' synonym). Then, synonyms were regrouped into categories and categories into themes to facilitate the analysis. An example of encoding key is presented in Table 3.

A contingency table of synonyms was then drawn up. A χ^2 and Fisher test was carried out on these synonyms to observe which are quoted significantly the most for each studied subject.

In addition to processing the FWAT as the images of the six studied terroirs, these results were compared to global conceptual typicity factors highlighted by HRGs during focus groups.

RESULTS

Conceptual typicity of terroirs by HRGs

Global conceptual typicity

Table 4 presents the consensual points from the debates of focus groups on different themes for the six terroirs. According to this table, each terroir shows different typicities which can be explained by different factors. For all the HRGs, the typicity of their terroir is linked to the soil, the geography and the grape varieties used. These three factors show, according to HRGs, that the studied terroirs are different, and also the importance of these factors on the construction of typicity. Moreover, while five terroirs insist on the importance of one or two grape varieties, Terroir C assumed to use variety blending. Climate, mentioned by five HRGs, seems to be another important point for the typicity of terroirs. History and human factors have also been identified as important for the typicity for four of the studied terroirs. History is mentioned as the former one, with the Roman history of wine of the Languedoc region, and as the most current one, by HRG of terroir F. Other factors such as viticulture and winemaking are less mentioned, only by half of the HRGs. Even if several themes were mentioned by HRGs, the majority of debates were about the natural environment of terroirs. Finally, factors such as the

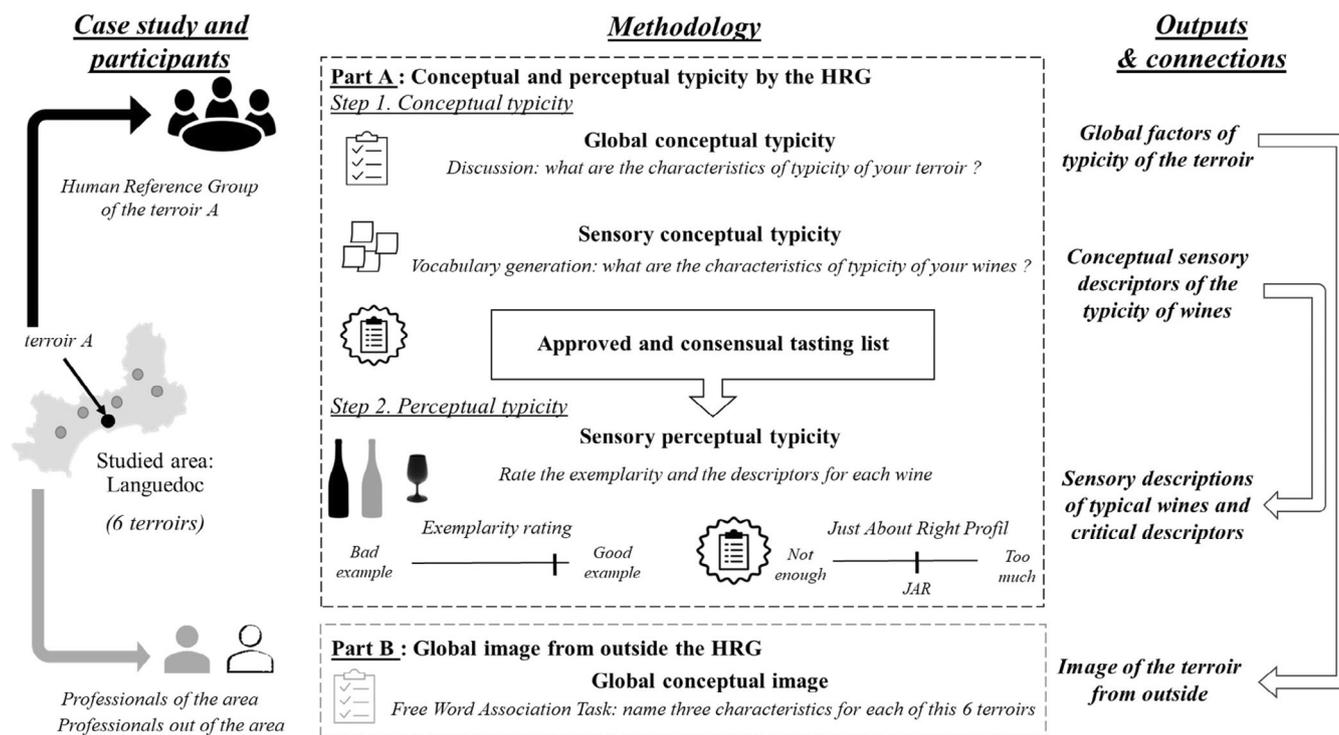


Figure 2 Diagram of the participative approach methodology.

economy or the image of the terroir (reputation) have been quoted by participants in several focus groups. However, the images of terroirs have been studied with professionals outside these HRGs, allowing a comparison between the images of the terroirs given by the HRGs and the ones perceived by professionals outside these groups.

Sensory conceptual typicity

Table 5 presents typicity descriptors chosen by consensus within the HRGs for each terroir. Regarding sensory conceptual typicity, the main output of this step was the list of sensory typicity descriptors selected. Several terms are common to all studied terroirs, for example scrubland or tannins. Moreover, spices and fruit aromas such as red fruits, black fruits or ripe fruits are often

mentioned. These points in common can be linked to the regional scale of the study where wines from different but close terroirs can have sensory similarities.

Concerning more specific terms with different definitions according to the terroir, ‘minerality’ could be mentioned, used for Terroirs B, C and E. For Terroir B and E, minerality was linked to the soil, and participants defined it as stone aromas and mouth-feel. For Terroir C, the proximity of the sea resulted in a definition of minerality closer to a saline perception.

Finally, some words only occurred for one terroir, for example ‘woody’ for Terroir A, ‘balance’ and ‘persistence’ for Terroir B, ‘density’ for Terroir C and ‘floral’ for Terroir E.

Sensory perceptual typicity by HGRs

For the six terroirs, five tastings showed significant differences between samples for the exemplarity rating (according to ANOVA at the 10% confidence level). Samples were not discriminated for Terroir C ($P = 0.216$). For each case, one or more products were significantly considered as ‘good example’ of the terroir typicity according to a Fisher LSD test (Table 6). In every case, at least one of the products considered significantly as ‘good example’ was a wine from the terroir. For Terroirs A, B, E and F, only wines from terroirs are considered as ‘good examples’ (A_02, A_05, A_04, A_03, A_01 and A_09; B_04; E_01, E_05 and E_06; F_01, F_03, F_06, F_08 and F_07). In the case of Terroir D, one OUT product is considered as a ‘good example’ (OUT_02) and as good as three samples from the terroir (D_03, D_02 and D_05). Considering the ‘bad examples’, in each case, at least one of the products considered as ‘bad example’ is an OUT sample. ‘Bad examples’ are only OUT samples for Terroir A (OUT_01, OUT_02 and OUT_04) and Terroir F (OUT_04 and OUT_01). For some, ‘bad examples’ are both OUT wines and wines from terroirs: Terroir B (B_08, OUT_01 and B_05) and Terroir D (OUT_01, D_08 and

Themes	Categories	Synonyms
Economic	Economic model	Cooperative cellar, merchant
	Offer	Supermarket, wine shop
	Price	Quality–price ratio
Sensorial	Gustatif	Tannins, astringency
	Hedonic	I like, good
	Olfactif	Pepper, fruity
	Sensorial	Balanced, bold
Terroir	Visual	Grenat, red
	Variety	Carignan
	Climate	Cold, rainy, sun
	Human/practices	Variety selection, grass cover
	Soil	Schist, limestone
	Terroir	Terroir

Table 4 Consensus from focus group of each terroir on different topics involved in typicity

	A	B	C	D	E	F
Soil	Limestone	Limestone	Schist	Complexity of soil, pebbles	Limestone	Limestone
Climate	Warm	Sunny but windy, with a special light, freshness	Microclimate, evolving with global warming	Hot and windy		Freshness
Geography	Pinada hill and Corbières mountain, 'hills giving gentle landscape', chalk mines	Former island, sea influence	Terroir of nature, various altitudes with influence on vines and wines	Large space open with plains, Black mountain	Country-style landscape, small denomination	Pic-saint-Loup mountain, proximity to Montpellier, environment
History and heritage	Old terroir with Pinada hill, resisting terroir	Roman history, strong heritage		Strong history of wine		Rather recent denomination although historical terroir of the Languedoc denomination
Human factors	Strong human federation to create the denomination years ago	One producer really known			Strong solidarity between producers, importance of cooperative cellar, commitment of the municipality	Cohesion of women and men to carry the denomination
Grape variety	Carignan really important, Syrah	Mourvèdre	No predominant grape variety, blending	Grenache	Syrah	Syrah really important and adapted for the terroir
Viticulture		Keeping freshness on vineyard	Organic viticulture, good sun exposure of bunches, limited yields			Quantity and quality, importance of grape maturity
Winemaking	Winemaking in barrel, 'wood to soften the tannins'	Barrel ageing			Traditional method, barrel ageing	
Economy		Proximity of Narbonne brings tourism, exports increasing	Good price–quality ratio, economic niche with organic viticulture	Tourism increasing but terroir quite new, necessity to express a clear image	Exports	
Image	Rustic but with a strong identity	Diversity of wine, necessity to develop more but already seen as a 'premium denomination'	Well known, almost famous, 'as known as the most famous in the region', but inquiry about identity and necessity to improve marketing	Quality of the wine but still in development	Historical terroir but developing slowly, little-known by consumers	Famous, appreciation of the quality of wine, dynamism of marketing

OUT_04). Finally, for Terroir E, the two 'bad examples' are samples from the terroir (E_08 and E_02).

Considering the JAR profile, penalty analysis is used to show which descriptors affect negatively the exemplarity rating for one product. Figure 3 presents the penalty analysis for product OUT_01 at the Terroir F tasting, a 'bad example'. Descriptors on the top right corner are those that impact more negatively the exemplarity rating, thus a lack of black fruit aromas, red fruit aromas and scrubland aromas. While this method shows descriptors

penalizing the exemplarity rating, it does not highlight descriptors which explain why a product is considered as a good example. Moreover, it gives an analysis per product and not a global one. This information can be provided by FCA of the numbers of 'not intense enough' (rating under 4), 'just about right' (rating between 4 and 6) and 'too intense' (rating over 6) calculated for each product and each descriptor in a given tasting (illustrated in Fig. 4 for Terroir F).

For this FCA, products considered as bad examples, OUT_01 and OUT_04, are described by a lack of black fruit, red fruit and

Table 5 Typicity descriptors selected by consensus by HRG of each terroir

A	B	C	D	E	F
Woody	Complexity	Complexity	Acidity	Spices	Acidity
Freshness	Spices	Density	Alcohol	Floral	Alcohol
Black fruits	Balance	Freshness	Spices	Black fruits	Spices
Scrubland	Black fruits	Scrubland	Red fruits	Red fruits	Freshness
Roundness	Scrubland	Minerality	Length	Scrubland	Ripe fruits
Length	Minerality	Tannins	Roundness	Length	Black fruits
Pepper	Persistence		Tannins	Minerality	Red fruits
Strength	Tannins			Roundness	Scrubland
Tannins	Volume			Tannins	Tannins

scrubland aromas as shown by penalty analysis for OUT_01. Moreover, an excess of acidity and a lack of freshness could also explain why they are considered as bad examples. FCA indicates that some good examples (F_01, F_03, F_07) are described by typical black fruit, red fruit, ripe fruit and scrubland aromas, typical freshness, acidity and tannins. However, F_06 and F_08, other good examples, seem to be also described by typical spice aromas and an excess of alcohol and tannins. Here, a descriptor rated as 'too much' does not necessarily imply a decrease of the exemplarity of the product.

Table 7 summarizes the descriptors linked to wines considered good and bad examples for each terroir according to the FCA done on the JAR profiles. JAR notation, analyzed by penalty analysis and FCA, allows determination of descriptors penalizing exemplarity rating for the tasters, but also of those which are linked to the sensory perceptual typicity identification.

In the case of F_06 and F_08, this method also highlights the internal variability of the typicity. Samples can be good examples even if they are not 'just about right' on every descriptor.

Images of terroirs by professionals outside of the HRG

The FWAT presents a total of 6322 words quoted by 420 interviewees, all professionals of the wine sector, and outside of HRGs of the six studied terroirs. For treatment, only synonyms with more than 15 total quotations have been analyzed, these synonyms representing 13% of the quoted words which cumulate 73% of the total quotations (Table 8).

The bottom half of Table 8 presents the most quoted words with no significant differences between terroirs. Indeed, some words are linked to the studied area itself like 'Languedoc' or 'Domaine'. But the majority of words describe characteristics of wines such as 'finesse', 'rich', 'softness', 'character', 'good', 'black fruits' and 'aromatic'. These words illustrate the vision of the Languedoc region more than the vision of the studied terroirs.

In the upper half of the table, words are significantly more quoted for one terroir according to a χ^2 and Fisher test (in italic in Table 8).

Some soil particularities are quoted: 'limestone' for Terroir B and 'schist' for Terroir C. Climate is mentioned with 'sun', 'heat' and

Table 6 Summary of ANOVA and comparison Fisher LSD test for each terroir on the exemplarity rating

	A		B		C		D		E		F	
	Sample	Exemplarity	Sample	Exemplarity	Sample	Exemplarity	Sample	Exemplarity	Sample	Exemplarity	Sample	Exemplarity
	A_02	7.351 a	B_04	6.751 a	C_04	6.971 a	D_03	6.401 a	E_01	7.479 a	F_01	5.822 a
	A_05	7.027 a	B_03	6.243 ab	C_03	5.789 ab	OUT_02	6.136 a	E_05	6.374 ab	F_03	5.567 a
	A_04	6.356 ab	B_09	5.533 ab	C_02	5.547 ab	D_02	6.037 ab	E_06	6.350 abc	F_06	5.447 ab
	A_03	5.782 abc	B_07	5.323 ab	C_10	5.317 ab	D_05	6.008 ab	E_07	5.803 abcd	F_08	5.384 ab
	A_01	5.730 abc	B_06	5.241 ab	OUT_03	5.307 ab	D_04	5.532 abc	OUT_02	4.963 abcd	F_07	5.239 abc
	A_09	5.711 abc	B_01	4.814 ab	C_06	4.946 ab	D_07	4.995 abc	E_03	4.794 bcd	F_04	4.691 abcd
	A_10	5.378 abcd	OUT_03	4.705 ab	C_01	4.930 ab	D_01	4.636 abcd	OUT_03	4.210 bcd	F_09	4.663 abcd
	OUT_03	5.160 abcd	OUT_04	4.686 ab	C_07	4.626 abc	D_06	4.314 abcd	E_04	4.019 bcd	OUT_03	4.349 abcd
	A_08	4.356 bcde	B_02	4.476 ab	OUT_02	4.584 abc	OUT_03	3.664 bcd	OUT_04	3.790 bcd	F_02	3.564 bcde
	A_06	4.066 bcde	OUT_02	4.283 ab	C_09	4.350 abc	OUT_01	3.244 cd	OUT_01	3.776 cd	OUT_02	3.409 cde
	A_07	3.679 cde	B_08	3.229 bc	OUT_04	4.196 bc	D_08	3.144 cd	E_08	3.613 d	F_05	3.328 cde
	OUT_01	3.094 de	OUT_01	3.014 bc	OUT_01	4.090 bc	OUT_04	2.320 d	E_02	3.269 d	OUT_04	3.271 de
	OUT_02	2.500 e	B_05	0.378 c	C_05	3.550 bc					OUT_01	1.894 e
	OUT_04	1.924 e			C_08	2.100 c						
Pr > F (Sample)		0.0001		0.064		0.216		0.010		0.030		0.001

Samples named A, B, C, D, E or F are from the terroir tested during the tasting. Samples named OUT are from a terroir different from the one tested during the tasting. Data for each terroir followed by the same letter are not significantly different according to the Fisher LSD test (10%).

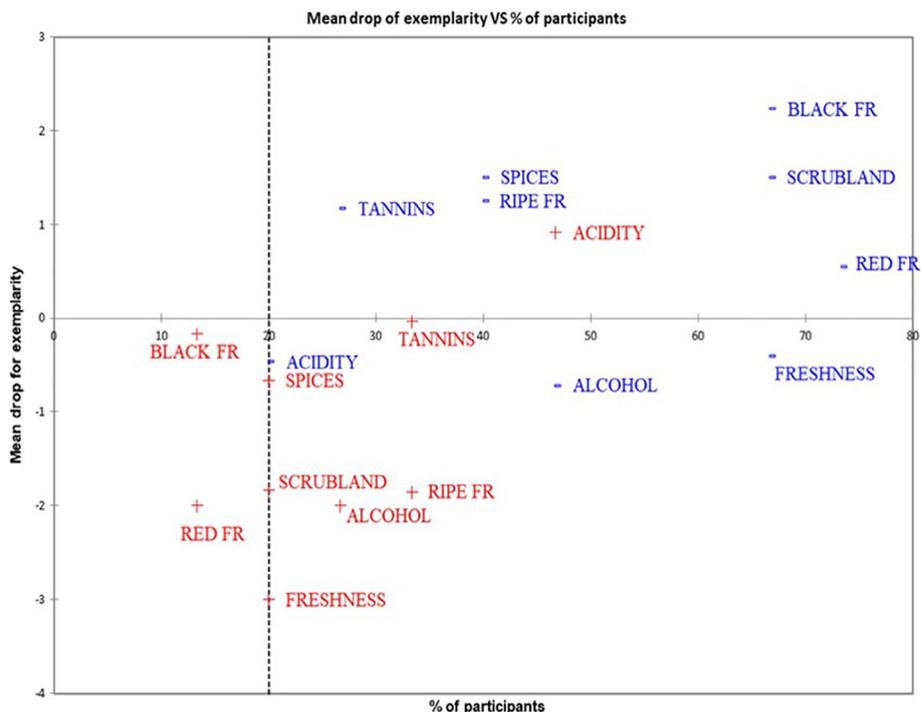


Figure 3 Penalty analysis of the product OUT_01 for Terroir F tasting (15 participants). Descriptors marked (–) are ‘not intense enough’, those marked (+) are ‘too intense’. FR, fruits.

‘wind’ for Terroir B. Some geographic points are raised as ‘sea’, ‘Narbonne’ and ‘Mediterranean’ for Terroir B, ‘Montpellier’ and ‘mountain’ for Terroir F. Geography is also used as the size of terroirs, such as ‘small’ for Terroirs A and E, and ‘big’ for Terroir D. Moreover, the ‘Terrasses du Larzac’ quoted for Terroir E can be considered as a geographical location of the terroir, or a

confusion with another one. History is little mentioned, ‘former’ for Terroir C and ‘history’ for Terroir D. Human factor is only addressed for Terroir E: ‘cooperative’. Concerning grape variety, ‘Carignan’ is quoted for Terroir A while ‘Syrah’ is mentioned for Terroir F. Winemaking is not mentioned and one viticulture point is raised: ‘organic’ for Terroir C. An economic point is raised for

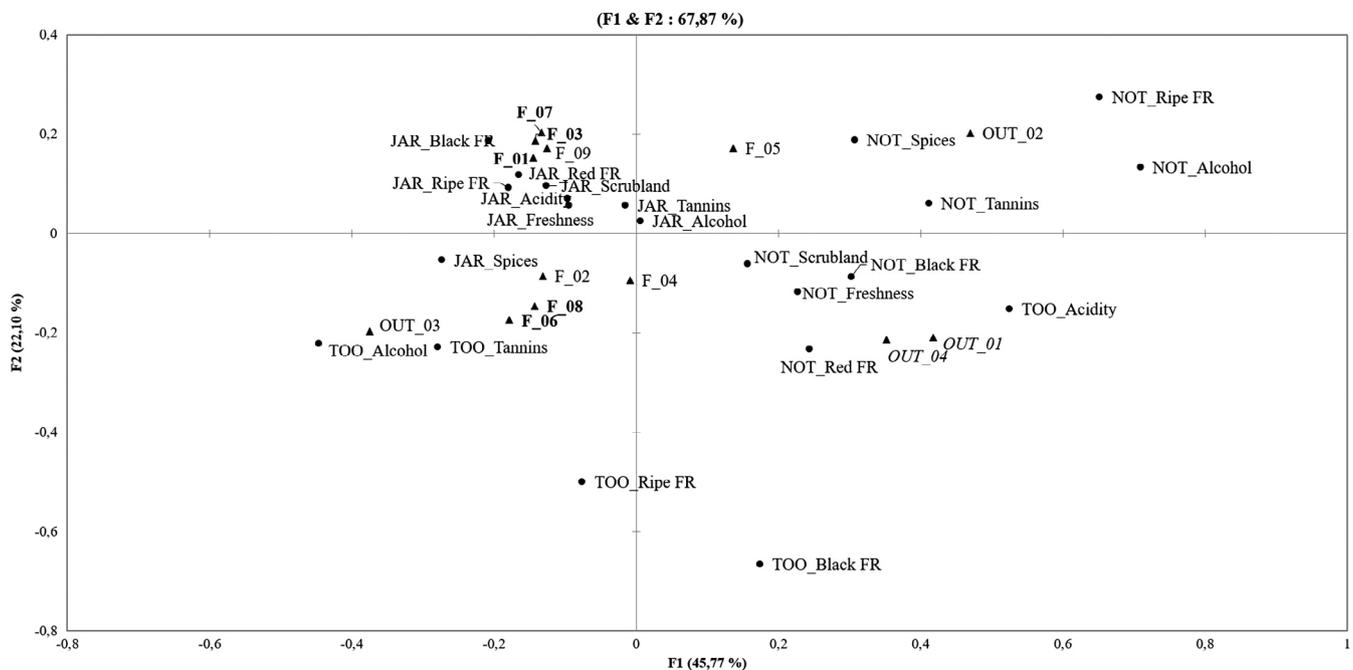


Figure 4 FCA of products of Terroir F tasting and JAR rating. Products in bold (F_01, F_03, F_06, F_07, F_08) are significantly considered as good examples of their terroir, according to tasting. Products in italic (OUT_01, OUT_04) are significantly considered as bad examples of their terroir, according to tasting. FR, fruits.

Table 7 Summary of FCA of the numbers of 'not intense enough', 'just about right' and 'too intense' for each JAR profile of each studied terroir

	A	B	C	D	E	F
Descriptors for good examples	JAR_Length, JAR_Strength, JAR_Tannins, JAR_Roundness, TOO_Woody, TOO_Tannins	JAR_Spices, JAR_Complexity, JAR_Minerality	JAR_Freshness, JAR_Tannins	JAR_Tannins, JAR_Acidity	JAR_Red-fruits, JAR_Black-fruits, JAR_Roundness, JAR_Minerality, JAR_Freshness	JAR_Red-fruits, JAR_Black-fruits, JAR_Freshness, JAR_Scrubland, JAR_Acidity, JAR_Ripe-fruits, JAR_Tannins, TOO_Tannins, TOO_Alcohol
Descriptors for bad examples	NOT_Strength, NOT_Tannins, NOT_Length, NOT_Roundness	NOT_Spices, NOT_Persistence, NOT_Balance	TOO_ Freshness	NOT_Spices, NOT_Red-fruits	NOT_Tannins, NOT_Spices, NOT_Roundness, NOT_Scrubland, NOT_Black-fruits, NOT_Red-fruits	NOT_Red-fruits, NOT_Black-fruits, NOT_Scrubland, NOT_Freshness, TOO_Acidity

Terroir C with 'quality-price ratio'. Some words can be considered as a quality mark: 'cru' for Terroir A, 'appellation' for Terroir C. Concerning the image of terroirs, results oppose for Terroir E with 'unknown' and 'little-known' and Terroir F with 'fashion', 'known' and 'notoriety'. Finally, many sensory descriptors are cited: 'spices', 'concentrated' and 'complex' for Terroir A; 'white' and 'salty' for Terroir B; 'red', 'tannins', 'mineral' and 'round' for Terroir C; 'fruit', 'tannins', 'structured' and 'light' for Terroir D; 'scrubland' and 'gourmand' for Terroir E; and 'elegant' and 'full-bodied' for Terroir F.

Some words are difficult to interpret, for example 'strong' for Terroirs A and C, which can qualify wines as well as the human community, described by the HRG of Terroir A. For Terroir A, 'terroir' is by definition a complex term and may have several meanings. For Terroir C, 'diversity' might be related to the soil, the climate or wines, because the word 'big' is also mentioned. Finally, 'freshness' for Terroir F might be related to climate, as highlighted by the HRG during the focus group, or to an organoleptic descriptor, also mentioned by the HRG.

Table 8 Words quoted during the FWAT by 240 interviewees outside of the HRG for each terroir

A	B	C	D	E	F
<i>Strong</i> (53)	<i>Sea</i> (95)	<i>Schist</i> (96)	<i>Fruit</i> (52)	<i>Unknown</i> (96)	<i>Montpellier</i> (55)
<i>Carignan</i> (42)	<i>White</i> (33)	<i>Red</i> (27)	<i>Strong</i> (47)	<i>Little-known</i> (31)	<i>Freshness</i> (47)
<i>Spices</i> (28)	<i>Sun</i> (33)	<i>Tannins</i> (21)	<i>Diversity</i> (21)	<i>Small</i> (17)	<i>Syrah</i> (35)
<i>Cru</i> (27)	<i>Salty</i> (22)	<i>Mineral</i> (19)	<i>Tannins</i> (20)	<i>Cooperative</i> (16)	<i>Elegant</i> (27)
<i>Concentrated</i> (19)	<i>Narbonne</i> (21)	<i>Round</i> (17)	<i>Appellation</i> (18)	<i>Scrubland</i> (15)	<i>Mountain</i> (26)
<i>Terroir</i> (19)	<i>Limestone</i> (20)	<i>Former</i> (14)	<i>Structured</i> (15)	<i>Gourmand</i> (13)	<i>Fashion</i> (16)
<i>Complexity</i> (14)	<i>Mediterranean</i> (17)	<i>Organic</i> (10)	<i>Big</i> (10)	<i>Terrasses du Larzac</i> (13)	<i>Known</i> (15)
<i>Small</i> (13)	<i>Heat</i> (16)		<i>Light</i> (10)		<i>Full-bodied</i> (12)
	<i>Wind</i> (11)		<i>Quality-price ratio</i> (7)		<i>Notoriety</i> (12)
			<i>History</i> (6)		
<i>Finesse</i> (10)	<i>Finesse</i> (16)	<i>Finesse</i> (24)	<i>Finesse</i> (16)	<i>Finesse</i> (17)	<i>Finesse</i> (27)
<i>Domaine</i> (6)	<i>Domaine</i> (11)	<i>Domaine</i> (11)	<i>Domaine</i> (7)	<i>Domaine</i> (11)	<i>Domaine</i> (7)
<i>Rich</i> (13)	<i>Rich</i> (5)	<i>Rich</i> (4)	<i>Rich</i> (11)	<i>Rich</i> (5)	<i>Rich</i> (9)
<i>Languedoc</i> (5)	<i>Languedoc</i> (5)	<i>Languedoc</i> (10)	<i>Languedoc</i> (7)	<i>Languedoc</i> (10)	<i>Languedoc</i> (8)
<i>Softness</i> (2)	<i>Softness</i> (9)	<i>Softness</i> (10)	<i>Softness</i> (8)	<i>Softness</i> (5)	<i>Softness</i> (7)
<i>Character</i> (7)	<i>Character</i> (2)	<i>Character</i> (9)	<i>Character</i> (7)	<i>Character</i> (3)	<i>Character</i> (10)
<i>Good</i> (4)	<i>Good</i> (5)	<i>Good</i> (3)	<i>Good</i> (8)	<i>Good</i> (7)	<i>Good</i> (8)
<i>Black fruits</i> (5)	<i>Black fruits</i> (4)	<i>Black fruits</i> (4)	<i>Black fruits</i> (7)	<i>Black fruits</i> (3)	<i>Black fruits</i> (4)
<i>Aromatic</i> (5)	<i>Aromatic</i> (5)	<i>Aromatic</i> (2)	<i>Aromatic</i> (6)	<i>Aromatic</i> (2)	<i>Aromatic</i> (7)
<i>Typicity</i> (6)	<i>Typicity</i> (5)	<i>Typicity</i> (4)	<i>Typicity</i> (3)	<i>Typicity</i> (6)	<i>Typicity</i> (8)

Words presented have a total quotation frequency over 15. Words in italic are significantly more quoted for one terroir according a χ^2 and Fisher LSD test. Numbers in parentheses represent the quotation frequencies of the words for the terroir.

DISCUSSION

The combination of methodologies used for the six terroirs from Languedoc highlights the typicity of terroirs and wines and allows discrimination of the typicity of each studied terroir. One of the main originalities of this study was the choice to work with both conceptual and perceptual typicalities of terroirs and wines, whereas previous studies of typicity have often focused only on the sensory perceptual typicity of products.^{12,38}

Concerning the global conceptual typicity, HRGs gave precise information and raised different themes such as historical, geographical, natural, human or technical factors, and the links between them. The consensus built within the HRG adds a different dimension to this study, allowing HRG members to confront and discuss their ideas and to identify typicity characteristics upon which every member agrees. Consequently, this study confirms the importance of involving the HRG in a typicity study, as a group, as highlighted by Casabianca *et al.*¹¹ with a consensus step. Regarding typicity factors expressed, the HRG vision is closer to the terroir and the natural factors of its environment than the vision of professionals outside the HRG, more attached to the reputation of the terroir and the characteristics of wines. This comparison highlights even more the knowledge of HRG members and the gap between the conceptual typicity they share and the image perceived by other professionals.

HRG members of each studied terroir were able to identify together factors of typicity and validate a shortlist of descriptors of sensory typicity understandable by all the participants. These lists are different even if some of the terms such as astringency or fruity aromas are often mentioned.

In five of the six studied terroirs, at least one wine from the terroir has been significantly rated as a 'good' example during blind tasting, while 'bad' examples were mainly outsiders. These outsider samples were intended to confront the HRG with other PDO wines. Indeed, a product from outside a PDO can be a good example of its typicity, depending on its organoleptic characteristics.¹³ JAR profile analyzed by FCA allowed highlighting the sensory characteristics of the good and bad examples discriminated, including PDO wine variability into the typicity study, which was impossible with penalty analysis. Previous studies of wines from a PDO showed a sensory diversity within a PDO.³⁹

However, in this study, the robustness of the results for some terroirs can be questioned because of the small number of participants involved. The organization of the methodology, particularly the focus group, limits the maximum number of participants by meeting to 10 while tastings would require more. But the purpose of this two-step gathering is to strengthen the consensus of the sensory test. As indicated by Murray *et al.*, for a descriptive sensory test, the first step of a panel training is the development of a common language to describe products 'comprehensively and accurately'.⁴⁰ The most structured way to select descriptors is by a consensus procedure,⁴⁰ allowing participants to understand the tasting list but also to confront others with their ideas and to explain some vocabulary. Indeed, according to Hunter and McEwan, vocabulary misunderstandings during sensory analysis can be solved through complete definitions or standards.⁴¹ The debate about sensory descriptor selection for the tasting is a kind of sensory training. In this study, bringing together the two methods, focus group and tasting, in one step ensures tasters participate in the training part before the tasting, and leads to a better consensus during the sensory test.

Nevertheless, members of HRGs have been selected only on the basis of their involvement in the terroir as professionals and their commitment to participating. Many authors have highlighted the importance of the representativeness of a group and the sociable homogeneity during a focus group.^{12,27} According to Casabianca *et al.*,¹¹ HRGs should also be composed of some consumers in order to be representative of the integrality of the stakeholders. In the present project, defining the typicity with the professional members of HRGs can be considered as a first step. It would be interesting to integrate consumers to add a complementary point of view. Indeed consumers within the HRG can appreciate the typicity of a product,¹¹ and are also able to define some specific typical properties.

Moreover, organizing several focus groups would allow one to combine more producers in a terroir, to be more representative of the entire HRG and to strengthen results. Some authors highlight the efficiency of iteration of meetings during projects led by a participative method.⁴¹ Indeed, a review of participative studies in different sectors concluded that principal limits on participative projects are organizational, practical or timing issues for participants.^{42,43} Once all the focus groups had been completed and analyzed, participants could be gathered once more to share all their results, and express their agreement or disagreement on points raised during the focus groups. During this second meeting, results of FWAT done by professionals outside of HRGs could be presented to confront participants with this vision, external to their PDO. Also, focus groups or FWAT could be led by consumers, outside the HRG, in parallel and results also presented to the HRG. The exchange of ideas on the perceived typicity by the HRG and the external vision from professionals and consumers could lead to a strong communication strategy.

A tasting could also follow this iterative method, if a descriptor list was validated during focus groups, with a consensus. This tasting could be linked to the second meeting, or organized afterwards, in one or more groups, with a reminder of chosen descriptors at the beginning. In the case of a third meeting for the tasting, it is important to ensure that tasters participated to the two previous parts. During this tasting, consumers inside the HRG could also participate, in order to compare the perceived typicity by professional members of the HRG and the one perceived by consumers from this HRG.

In addition to this whole organization, a quantitative descriptive analysis (QDA)^{44,45} performed by an expert panel could be done, to observe the differences or similarities between wines from studied terroirs.¹² Even if HRGs selected and showed by their tasting some descriptors of typicity of their wines, a QDA could validate the relevance of these descriptors and add more descriptors of these wines.⁴⁶

The methodology proposed here could be used in different places, in France or elsewhere in the world, and even for other types of products linked to the terroir, like cheese⁴⁷ or coffee,⁴⁸ in order to highlight their typicity. As shown by the result of focus group, HRGs members strongly associate the typicity of terroirs with the natural environment. This environment affects the decisions taken by HRGs in order to express the typicity of their terroirs for their products. Participative approach in typicity studies is a force for the wine community to face today's great challenges, such as global warming and reduction of inputs, and to improve specifications and criteria of control of sensory characteristics of typical products.

Finally, studying typicity of terroirs or PDO allows one to address different messages according to target consumers. The full set of

PDO of an area needs to be easy to understand by the consumer.⁴⁹ For consumers, regional vineyards in France can be considered as brands and the region of origin of a wine is an important factor of choice.^{50,51} For New World wine, consumers have long favored the grape variety or the brand, but now a trend of terroir is also arriving in these regions.⁵ A scientific tool such as sensory analysis could objectively define the sensory characteristics of typical products, in order to have specific information for expressing the terroir and to educate consumers to recognize the specificities of the typical products coming from a particular terroir.⁵²

CONCLUSIONS

The methodologies chosen to study conceptual and sensory perceptual typicity of six terroirs of Languedoc allowed identification of the typicity of each terroir. The study of two populations, HRGs and outside HRGs, shows the gap between the typicalities identified and those perceived by professionals outside HRGs.

In general, global conceptual typicity, according to HRGs, is linked to the natural environment of terroirs, which influences the human and technical factors involved in the typicity. However, global factors (soil, climate, human, etc.) discriminate to a greater degree the six studied terroirs than descriptors selected for sensory conceptual typicity. This proximity between sensory conceptual typicity of studied terroirs could result from the regional scale of the study.

Concerning professionals outside of HRGs, their vision is mainly based on the reputation of the terroir and the organoleptic characteristics of wines even if some environmental factors are mentioned.

Concerning the sensory perceptual typicity, five of the six studied terroirs discriminated samples according to their exemplarity. 'Good' and 'bad' examples of the sensory typicity identified for each terroir were then challenged by JAR profile to highlight descriptors involved in the sensory perceptual typicity.

Participatory approach and sensory analysis, as scientific tools, could objectively define typical characteristics of terroirs and products, in order to have specific information for expressing the terroir and to help consumers to recognize the typicity of products.

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