Tasting

CHEMICAL OBJECT REPRESENTATION IN THE FIELD OF CONSCIOUSNESS

Frédéric Brochet

INTRODUCTION

Tasting carried out by the wine grower, the oenologist, the wine-broker, the wine merchant and above all the wine lover is a fundamental act in the life of a wine. For the professional of production it serves as a guide to the elaboration of wines and it's towards this final act in the life of the liquid that all their efforts are aimed as it's this result alone that counts for the consumer. During the last twenty years, knowledge of the physcio-chemical composition of wines has progressed considerably, to such a point that it has become the foundation of wine making. Paradoxically, in regards of its central position, the practice and teaching of tasting rests on rather fragile theoretical bases going back to the founding fathers of the discipline, André Vedel and Peynaud. (Peynaud, E., 1981, Vedel, A., et al., 1972).

Within this context, our work concentrated on establishing the fundamental theories of the practical act of wine tasting. Tasting is representing. In fact when the brain carries out a "knowledge" or "understanding" task, it manipulates representations. The taste of wine is in fact a perceptive representation as it relies on an interaction with the real, the conscious. The problem therefore is to endeavour to understand the means of constituting representations of elaborated wines during tastings, a problem not directly of oenology but of cognitive psychology and cognitive neuroscience. We consider therefore that there exists a relationship between psychic phenomena and neuro-biological phenomena. The first finding expression in acts and words.
There are 3 means of study of representations:

- Textual analysis, which uses a statistical treatment of subjects' verbalisations.
- Behaviour analysis, which by observing subjects, infers underlying cognitive mechanisms.
- Cerebral function imaging which permits, as directly as possible, access to cortical activation, through visualising the brain in action.
During this study each of these methods was used.

1. TASTING CORPUS TEXTUAL ANALYSIS

Textual analyses rely on the statistical study of the components of a text: the lexis or the co-occurrence for example. Their use in studies, sometimes highly mediatised, has made them famous notably in cases of certification of the authorship of a text, speed-reading and in order to elucidate the sense of terms of dead languages or even in questionnaires. They are also used for the study of social representations (Jodelet, 1984). Their use in the framework of a study of perspective representations stems from the idea that it is possible to gather information on these representations from subjects' verbalisation. There exists in oenology a practice current and old, verbalisation of representations through the writing of tasting notes. We have therefore postulated that a tasting note, written by the taster contains information on the perceptive representation constructed during the tasting.

I.1 ALCESTE methodology

Bringing to the forefront the organisation of perceptive representations in verbal form was carried out through the use of the ALCESTE textual analysis software developed by Max Reinert of the University of Toulouse and capable of extracting the hard core of a corpus in carrying out an integral, and in a single block, reading of a text; in this case all the tasting notes of a single author (Reinert, 1983, 1990, 1993). The ALCESTE software is based on the counting of co-occurrences and furnishes a result in the form of a series of lexical fields in which each term is accompanied by statistical elements. What ALCESTE therefore carries out is a particular reading of the text: one that does not take into account the meanings of words, which does take into account entire words the nouns, the adjectives and the verbs, the only carriers of meaning, and ignores the syntactic cement of the text: pronouns, conjunctions and adverbs. It then counts the co-occurrence of entire words, that is to say, the recurrent appearance of words together in sentence segments. The selection of associations independent of the nature of the cutting brings out the so-called stable lexical fields of the text as well as their arborisation.

Each field must be interpreted from its content:

Entire words are of course the best indicators as they carry meaning.

Tool words were not used in calculations but permit a better delimitation of the discursive strategy of the speaker: many personal pronouns, adverbs of time and quantity.

So-called star words were added to the text by the analyst to signal certain characteristics of the text such as the age of the enunciator in the case of a questionnaire.

In our case the star words specified the information contained on the labels of the tasted wines.

Some characteristic quotations permitted a restitution of the terms in their context of use.

All of these attributes allow the analyst to give a title to the field.

1.2 ANALYSED CORPUS

5 corpus or texts were therefore analysed, the content of which is synthesised in the following figure:

Analysed corpus

Corpus	Author	Anonymity of samples	Number of tasting notes
Hachette	Collegial	Yes	100,000
G&M lettre	Jacques Dupont	No	3,000
Parker	Robert Parker	No	9,000
Personal	F.B.	Variable	2,000
Vinexpo	44	Yes	8 x 44 = 352

The first corpus is taken from the well-known and widely published work, the Hachette Guide to the Wines of France. Editions Hachette were kind enough to hand over to us the notes of 10 years of the guide, a total of more than 100,000 tasting notes. The tastings were carried out in a collegial fashion and the samples were tasted anonymously.

The second is extracted from a weekly publication, the Gault & Millau letter, whose publication has now ceased. Jacques Dupont, who handed over to us 3,000 notes, carried out the essential of these tastings.

The third corpus, Corpus P, compiles 29,000 tasting notes of the envied as well as criticised American author of the fortnightly publication "The Wine Advocate", Robert Parker. Every two months since 1978 "The Wine Advocate" publishes some 1,000 tasting notes, much awaited by tasters and the market. Its influence has constantly grown over the last 3 years. Tastings were not blind and Mr Parker did not hand over his notes so we bought the 9,000 notes on a CD from the Massachusetts company which commercialises it.

In addition to these 3 large corpus are 2 more modest corpus, a personal corpus comprising 2,000 notes and finally a special corpus which brings together notes, of 44 tasters of international reputation from the principal countries of wine production and consumption, of a blind tasting of only 8 wines each.

1.3 Textual analysis results

Here are the results of these analyses.

A) RESULTS OF DIFFERENT CORPUS

a) Corpus H Results

CORPUS H SYNTHETIC RESULTS

heart of	red	château	white
Burgundy			
Burgundy	plump	vintage	golden
vineyard	final	wood	floral
climate	dark	château	fresh
heart	intense	complexity	liqueurous
body	deep	mark	pale
honest	blackcurrant	matter	dry
bottle	cherry	property	apricot
pleasure	fruit	structure	lemon
perfect	ruby	volume	honey
sentiment	raspberry	personality	straw
style	spice	success	lively

ALCESTE extracted 4 classes of corpus from the Hachette guide.

The first segmenting of the tree is the fact of colour. Among the classes that describe red wines there is a vocabulary specific to Bordeaux and Burgundy regions.

Vocabulary meant to be descriptive of sensorial properties of wines often refers to imaginary themes: sentiment, climate…

b) Corpus D Results

CORPUS D SYNTHETIC RESULTS

old	texture	pleasant	gold	freshness
brown	ripe	agreeable	golden	floral
spicy	smooth	pretty	full	fresh
developed	blackcurrant	fruity	long	pale
dark	black	pleasant	fat	white
cocoa	extract	cherry	apricot	lively
cedar	tar	red currant	quince	butter
pin	matter	ruby	honey	lemon
tobacco	jam	raspberry	nut	apple
tiled	muscle	supple	peach	Boxwood
smoky	round	tender	pear	
brick		light	toasted	

From corpus D, ALCESTE extracted 3 classes strongly linked to the colour red and 2 strongly linked to the colour white, the wines described in these classes being respectively red wines and white wines. The coherence between the colours of different descriptive terms is especially remarkable with this author.

c) Corpus P Results

CORPUS P SYNTHETIC RESULTS

laudatory	pejorative	
great	amber	floral
amazing	closed	clean
blockbuster	earth	delicious
consumer's	cedar	fresh
vines	dusty	dry
enjoy	tannins	crisp
outstanding	herbs	pleasant
elegance	jammy	serious
no fining	austere	varietal
no filtration	chocolate	apricot
profound		zesty

From Mr Parker's corpus the analyst extracted 3 classes segmented by colour but also by this author's preferences. There is a vocabulary specific to wines appreciated by this author and another for…other wines.

d) Corpus F Results

CORPUS F SYNTHETIC RESULTS

Laudatory		pejorative			
light	powerful	thin	old	laudatory	Pejorative
fruity	sombre	hard	aged	golden	honey
flavoursome	full	vegetal	oxidised	buttered	bushed
fine	blackcurrant	thin	dry	fat	wax
red currant	plump	acid	tobacco	pear	coppery
sugar	excellent	bizarre	stripped	straw	aged
balanced	meat	dissociated	smoky	peach	rag
woody	plum	volatile	tiled	yeast	
strawberry	spicy	earthy		bread	
dense	tannin	hollow		lemon	
clove		terrible		flower	
open		sad		brilliant	

ALCESTE extracted 6 classes, strongly marked by the subject's preferences. Intended for personal use, this corpus includes several familiar terms.

B) SYNTHESIS OF TEXTUAL ANALYSIS RESULTS

Six results clearly stand out in these analyses

1) The classes are not indexed following sensorial modalities but describe types of wines. For the whole of the classes ALCESTE highlights that the structure of the authors' descriptive representations are based on the types of wines and not on the different parts of the tasting which are however the support of their analysis. The regrouping of terms "sombre, full, blackcurrant, plump, meat, plum, spicy, tannin" highlight the visual aspects (sombre), descriptive terms of olfactory (black currant, plum) and gustative (full, tannin) aspects. The representation is not constructed, as one might expect, on the basis of the different phases of the tasting which structure as much the method of tasting practised by the authors.

2) The representations in textual form are prototypical in nature:
The lexical fields refer in reality to types of wines, which means that there are specific vocabularies to describe types of wines and not independent lexis' for visual, olfactory aspects…A reading of the descriptive terms of classes evokes for the taster the taste in a large

sense, that is to say, the representation of a particular wine. The vocabulary represents therefore a type of wine: for example "concentrated" wines are described by one taster with terms "sombre, full, black currant, plump, meat, plum, spicy, tannin", and by another "ripe, flavoursome, black currant, extract, black, tar, matter, jam, muscle, rounded" but corresponding in reality to the same type of wine, to the same model, while the terms "floral, fresh, pale, white, lively, butter, lemon, apple, box wood" refer to a type of wine that might be brought together under the banner "Fresh", and which describe, for example, wines from Sauvignon or Albarino vines; other fields evoke clearly an "old wine" prototype such as that comprising the terms "brown, spicy, developed, cocoa, cedar, pine, tobacco, tiled, smoky, bricked". Identical for another field: evoking, for example, a Sauvignon: Fresh, finally, this other field evoking old wines. The description corresponds therefore to an unfolding of a series of descriptive terms which are linked to the representation of this wine for all its properties in as much as an example of the wine, that is to say, to a recognition of a global form.

3) Another result, the analysis shows that the descriptions are different. No diagram is identical, which means that the spaces of representation are different between authors. The lexical fields are different for the authors as much in the words contained in the fields, as in the wines associated with these fields, that is to say the wines that have been specifically described by the words in this field. It is not possible therefore to reunite more than 10 words belonging to the same field in common with 2 tasters. This highly heterogeneous structure of classes is subject to the crossed dependence of genetic and cultural factors. In fact the analysis of the Vinexpo corpus, which remember, brought together tasters from different countries (France, the United Kingdom, Japan, Spain, Switzerland, Greece…) and of different professions (wine waiters, cellarmen, journalists, wine merchants) did not highlight any correlation between the countries or the professions and the structuring of the classes. The existence of classes in this corpus reveals, in reality, that there exists a typology of tasters, that is to say, that there are "groups" of tasters, but these classes are the product of subjects' "characters"; their culture and their nature mark their representations in such a way that individual possesses his or her own discursive strategy. Therefore our study highlights that reference" prototypes for tastings do not exist and in a similar fashion, that it is illusory to define prototypes more "accurate" than others. Nevertheless the architecture of classes presents 2 identity criteria: that of giving way to the preferences of tasters and that of being strongly indexed by colour.

4) Fourth observation of lexical analyses: certain classes are linked to preferences, the preference is a key criteria in the constitution of classes. The classes of words "hard, vegetal, thin, acid, bizarre, disassociated, volatile, earthy, hollow, sad" as well as amber, closed, earth, cedar, dusty, tannins, herbs, jammy, austere, chocolate" show us that there is a specific vocabulary for preferred and non-preferred wines (in this case the two preceding classes are linked, as one might suspect, to non-preferred wines). These results are also confirmed by the

confrontation of the tasted wines with these words. The representation space is structured in function of the preferences of each author. Through these terms, more or less imaginative, these tasters tell us that they don't like this wine. In this sense their representation space is not that far from that of the novice, often segmented in two classes: that of good and bad wines. No taster seems even to be able to put his or her personal preferences to one side when representations are described. On the contrary preferences are an important anchoring point of representations. These results of the dependance of representation on preferences are very classical in the physiology of fragrances, as has been shown by numerous authors, (Berglund et al., 1973), (Distel et al., 1999); (Holley, 1999) from a physiological and linguistic point of view (David et al., 1997) but not well known, particularly in the wine world.

5) Fifth observation. Colour segments all classes. Colour is in fact the principal argument of the first segmenting of classes as is shown by the dendograms. Moreover the descriptive terms of classes are very coherent from the point of view of colour. Here for example are several perfectly coherent sequences "Rose, ruby, red currant, strawberry, cherry"; white, pale, green, yellow, almond, lemon, white flower, straw, hazelnut, white peach, box wood, broom, lime blossom, chalk"; "Golden, apricot, quince, honey, amber, praline, wax, melon, mango, yellow peach". Colour is therefore a major factor in the organisation of classes. Numerous studies have already highlighted this phenomenon of the influence of colour on perceptions. The first as far back as Dunker in 1939, continued by Pangborn (1960, 1963).

6) Cultural information is present in sensorial descriptions. In the classes "Burgundy, climate, heart, body, honesty, bottle, pleasure, perfect, sentiment, style" as well as in "great, amazing, outstanding, old vines, no fining, no filtration" are found a series of terms which are not linked to stimulation provoked by the glass present before the taster: honesty, sentiment, style…Certain descriptive terms referring to cognitive representation probably come from memory or information read or heard by the subject, bur neither the tongue nor the nose could be at the origin of the coding. All takes place as if the information proposed on the label or by a potential salesperson themselves generate sensorial information and the described characteristics. Practices such as no fining or no filtration do not always have organoleptic repercussions, but it seems that knowledge of these elements influences representation.

A recapitulation of the specificity's of the organisation of lexical fields stemming from the textual analysis by ALCESTE and which are the anchoring poles of representation:

-Classes are not indexed according to modalities but describe "types" of wine
-Representations are prototypical in character
-Author descriptions are different
-Classes are linked to preferences
-Colour segments classes of all corpuses

-Cultural information is present in sensorial descriptions.

Three of these hypotheses were tested in behaviour analysis studies.

II. EXPERIMENTAL CHARACTERISING OF SOME REPRESENTATION PROPERTIES HIGHLIGHTED BY LEXICAL ANALYSIS

The principle of behaviour analysis rests on the observation of subjects in experimental conditions in order to isolate underlying cognitive mechanisms.
The classic example of behaviour analysis is the Stroop test, in which it can be observed that Red written in red is read more quickly than blue written in yellow. This test permits, notably, to highlight that semantic and visual information on a word are treated in non-independent zones of the brain.

II.1) The first hypothesis tested was that in which colour directs description

To test this hypothesis we elaborated the following experimental schema: 54 subjects were invited to a series of two experiments in which they had to comparatively describe a real red wine and a real white wine. Some days later the same subjects had to comparatively describe, in their own words, the same white wine and a red-coloured white wine. The neutrality, from an olfactory and gustative point of view, of the colouring was controlled during another test. What the subjects see during the first as in the second experiment is a glass of white wine and a glass of red wine. What in fact is in the glasses during the first experiment a glass of red wine and a glass of white wine whereas during the second there were two glasses of identical white wine, except from the point of view of colour. In question was the perception of the subjects. The results are presented in the following figure.

RESULTS

Olfactory and gustative terms

54 subjects

red

white

The real red wine was described from an olfactory and gustative point of view in classical red wine terms. Whereas the white wine was described in usual white wine terms during this first experiment.

In a similar fashion the white wine of the second experiment was described with white wine terms, this opposed to the same white wine coloured red. The Chi test carried out on the descriptions permitted the affirmation that the subjects described the two wines of the colour red in an identical fashion whereas one of them presented the aromas of a white wine. On the contrary the presence of the colour red in the white wine reversed the description of its descriptive parameters.

In this experiment the perception of fragrance and taste conformed therefore to colour. This phenomena has been the object of an abundant literature (Maga, 1974, Dubose, 1980, Davis, 1981, Johnson, 1982, Zellner and Kautz, 1990 in the food processing field; and in the wine field (André, 1970, Williams, 1984). The principal conclusions of this work have also been practical: colourless syrups have disappeared from the market.

II.2) The second hypothesis was that in which imaginary information may be assembled into the representation

This hypothesis therefore was tested with the following experiment in which the same red Bordeaux superior wine was presented to 57 subjects at an interval of one week and under two very different labels. The first let it be understood that the wine was a table wine (VDT) while the second let it be understood that it was a prestigious GCC wine.

What the subjects were was that they were going to taste a simple wine and a great wine. What in fact was in the glasses was identical, average on both occasions. Stimuli were identical in the 2 tasting contexts. It was neither a table nor a vintage wine but a Bordeaux, the same in the 2 experiments.

II.2.1 Results:

The lead tasting panel therefore noted the wines very differently as is presented in the following distribution of notes.

Distribution of notes

Number of notes attributed

Notes out of 20

The descriptive terms used in the 2 conditions are also totally different as presented in the following figure:

Positive terms	GCC		VDT		Negative terms	GCC		VDT	
Agreeable	22	79%	6	21%	None	0	0%	9	100%
Full	7	87%	1	13%	Light	3	25%	9	75%
A lot	6	100%	0	0%	Short	1	14%	6	86%
Well	16	64%	9	36%	Fault	8	30%	19	70%
Woody	28	93%	2	7%	Unbalanced	1	17%	5	83%
Good	40	77%	12	23%	Disappear	0	0%	3	100%
Complex	16	73%	6	27%	Stable	1	17%	5	83%
Already	4	100%	0	0%	Weak	9	25%	27	75%
Again	4	100%	0	0%	Fluid	0	0%	6	100%
Balanced	36	65%	19	35%	Not	35	38%	56	62%
Excellent	3	100%	0	0%	A little	62	44%	78	56%
Fresh	4	100%	0	0%	Sting	3	21%	11	79%
Smoky	6	100%	0	0%	Flat	7	32%	15	68%
Long	15	79%	4	21%	Without	11	34%	21	66%
Flavoursome	4	100%	0	0%	Simple	0	0%	3	100%
Premier	23	74%	8	26%	Volatile	0	0%	4	100%
Round	16	100%	0	0%					

A lot replaces a little, complex replaces simple, balanced replaces unbalanced under the simple effect of the label.

II.2.2 Discussion

It was observed that the label or the colour influenced, in a preponderate fashion, subjects' representations. These two experiments may be explained through a phenomena highlighted by J. Bruner in 1950, that of perceptive expectation. The subject perceives, in reality, what he or she has pre-perceived and finds it difficult to back away.

From the point of view of knowledge in the matter of chemical sense, we propose that the phenomena are largely facilitated by the temporal quantitative interval between visual and olfactory-gustative information. Chemio-sensorial information is in fact 20 times less important and 10 times slower than visual information. Moreover, the activation of these paths is, even for experts, much less frequent, to a point that the reliability accorded to visual and imaginary information is higher than that accorded to chemio-sensorial information.

The capacity of non chemio-sensorial information, visual or coming from memory, to anchor itself in a reproducible fashion in the perceptive field contrasts with the high variability of olfactory or gustative elements, to a point that, in terms of cognitive validity, the first contrast with the hesitation of the second. The representation of olfactory-gustative elements is therefore pre-constructed by visual information of colour which conditions both verbalisation and perception, all elements of the representation.

It should absolutely not be imagined that the perceptive representation of great or small wines relies only on their label or their colour, but each of these factors contributes in an equivalent fashion to the construction of the representation. A sentence from E. Peynaud, "Blind tasting of great wines is often disappointing," finds here its justification; in a similar way that the weak interest in rosé wines, of which the expectation is never really up to the possible sensorial properties.

The hypothesis of very strong variations in representations, even among expert subjects, could also be demonstrated by a third experiment.

II.3) Experiment of classifying a number of wines by a panel of subjects

During this experiment subjects were asked to classify, in order of preference, 18 wines, totally blind: there are no identical classifications

<div align="center">Tasters</div>

Classification	T1	T2	T3	T4	T5	T6	T7	T8
1	18	12	11	12	10	10	11	12
2	1	8	6	8	14	14	12	7
3	4	10	7	4	7	16	14	11
4	9	14	5	10	16	2	3	10
5	7	2	12	16	12	7	4	4
6	10	6	2	2	17	12	2	9
7	12	7	15	14	2	3	17	2
8	14	11	3	3	4	8	6	3
9	17	17	8	9	6	11	10	14
10	16	1	18	11	8	13	5	1
11	15	3	14	6	11	6	7	8
12	11	4	9	18	9	18	8	13
13	3	9	10	17	13	4	9	17
14	8	15	13	1	3	17	13	15
15	6	16	4	7	1	15	15	6
16	2	5	1	5	15	1	1	16
17	13	13	17	13	18	9	16	5
18	5	18	16	15	5	5	18	18

The lowest interval between places is 7 and the maximum is 18, while the sum of ranks is not discriminant and does not permit affirming that one wine is preferred to another. These results are coherent with those obtained during many tasting competitions.

Conclusion: Important differences between representations of different subjects do indeed exist. The hypotheses that prototypical representations and visual influences validated by behavioural analysis were tested by functional cerebral scan.

III. FUNCTIONAL CEREBRAL SCAN BY NUCLEAR MAGNETIC RESONANCE

This work was able to be carried out thanks to the collaboration of Professor Jean-Marie Caillié and Dr Michèle Allard, who were kind enough to offer the opportunity of access to the IRM of the Pellegrin University Hospital Complex, attached to the University Victor Segalen Bordeaux II. The IRM examination was carried out in an intense magnetic field, isolated by a Faraday cage where the subject is lying. The IRM is based on following cerebral blood flow that is itself modulated by neuronal activity. Modifications in blood flow are detected by following in time a NMR signal generated by the precession of hydrogen atoms nuclear spin following an electromagnetic impulse and in an intense magnetic field, 1.5 Tesla, in the case of our study. The presence of more or less haemoglobin in a given region locally modifies the signal in relation to blood flow. These images of activation are superposed on anatomic images giving activation maps whose spatial resolution is excellent, millimetered, and a weak temporal resolution, in the order of several seconds.

In the uncomfortable position in the magnet it is possible to inject quantities of wine, allowing the subject to taste, and to record the activation generated in the brain by this stimulation. In our experiments the subjects received, eyes closed in the magnet, 6 times 1ml of the same wine, which was tasted for 24 seconds each injection separated by a rinsing with 50ml of water for the same duration. It might appear surprising to taste lying down and with only 1ml of wine but the experiment shows that a rather good perception of tastes and fragrances was obtained, in spite of the low quantity dispensed. Following this protocol, 4 subjects thus generated exploitable images.

III.1) Highlighting the prototypical character

The prototypical character of the perceptive representation was highlighted in all the subjects, as presented in the following figure.

Subject B
Subject R
Subject M
Subject L

The implication of these areas in perceptive representation of chemical stimuli is well known in literature, both by experimental pathology and tomography by positron emission data, as was shown by Robert Zatorre and Marylin Jones Gottmann. B. Cerf also established the implication of these zones in gustative perception.

These images are nevertheless the first images of cortical activation obtained using wine as stimuli.

The lateralisation of the activation in the right hemisphere of the brain allows us to justify the prototypical nature of the representation. This part of the brain is, in fact, known to be the seat of ideographic languages as opposed to alphabetic languages treated in the left hemisphere. It is also known for its activity more orientated towards emotions than precision leaving a place for strong interference with imaginary data of objects. This interference, translated by Claude Lévy-Strauss in the famous formula "what is good to eat must also be good to think," carries the term "magic thought" introduced by Claude Fischler, and which finds a new justification in our study.

This also permits us to think that the representation establishes itself by comparison to other representations and not by the literal enunciation of its properties.

III.2) Highlighting the holistic properties of the representation

The global form character, that is to say not only prototypical but holistic, of the representation is also highlighted by the activation in visuo-associative areas in the parietal cortex, visible in the following figure:

Subject M

Subject B

Activation in these areas signals that the perceptive representation of wine is not constituted only of activation in chemi-sensorial areas but in association with a number of other areas. This data justifying the strong interference as much with colour information as with imaginary information observed during the behavioural experiments.

This figure also highlights the differences in representations observed in different subjects with identical stimuli. With no other source of information other than those supplied by the wine, these subjects constructed different representations.

Subject M on the left is more visual while Subject B on the right of the figure is more verbal.

Other images have also highlighted that the representation vary rapidly for the same subject. When a subject tastes the same wine several times the images of each of these tastings highlight that the representation constructed at each injection is different. These images which are not reproducible, were long considered as experimental artefacts. However the validity of activation points confirmed by the excellent correlation between the stimulation paradigm and the temporal decrease of the signal permits the affirmation that it is indeed the expression of the variable character of the representation.

In reality, the preceding as well as these slides show the representation is a global form integrating, on equal terms, chemio-sensorial, visual, imaginary and verbal information.

III.3 Discussion

With all the subjects the IRM images of the representation show activation in the associative cortex. Following the injections these images show activation in temporal verbal areas and occipital visual areas, respectively linked to the verbal or visual dimensions of the representation.

All presents itself therefore as if the perceptive representation constructed by a subject during the tasting of a wine integrates, in time and in space, all the perceptive dimensions on equal terms and constructs, therefore, a complete representation of the wine at a moment T where it is no longer perfectly possible to separate the sensorial and the imaginary, the seen and the smelled. The act of perceptive representation allies itself, therefore, with a recognition of global form. The representations are therefore based on prototypes. The affirmation of the representation of a wine in its type is, therefore, the foundation of the appreciation of wines. There is an interest for the taster to discover representations outside his type but they do not always make sense.

The tasting is therefore prototypical in the sense that it relies on comparison.

Apprenticeship to tasting is perfected by the confrontation with types and this apprenticeship, as with an apprenticeship to Chinese, never ending and relies on a presentation and a judicious denomination of the principal types.

Recognition being a global recognition, it is not possible for the taster to know in all cases the origin of the aspects of its representation. The only way is to segment the access to the taster of the different dimensions of the representation. The appreciation therefore of only olfactory-gustative properties should be carried out in black glasses.

An appreciation in transparent glasses would give a different result as the perceptive representation of fragrances would have been foreshadowed by colour.

In a similar fashion, a tasting with or without labels does not produce the same representations.

A real organoleptic appreciation of a wine should be carried out in the absence of all imaginary reference, if not the representation will be modified. It is necessary to reflect well on the questions asked during this tasting and to ensure the total absence of any subliminal clue including the colour of a capsule and other bottle tints.

But it is also necessary to bear in mind that the result of such a tasting is not able to reproduce the elaborate representations in usual conditions as such a representation is not the linear sum of each of its dimensions.

Moreover the strong variability in these representations should give rise to an extreme caution in the presentation of results. An indispensable advance would be achieved through the signalling of a note of consensus.

CONCLUSION AND PERSPECTIVES

Three experimental methods have provided a body of converging arguments to clarify the foundations of the perceptive representation of wine and the mechanisms of construction of the perceptive representation by the wine taster. This work demonstrates the phenomena that, in the end, is well known to wine tasters but which, up to now, has not had either the scientific demonstration nor the theoretical support. The origin of these phenomena has presently been clarified.

The work focused on the mode of elaboration of perceptive representations of chemical objects with for a model of the latter, wine. The availability of a descriptive corpus of these representations elaborated by wine tasters has permitted the use of a textual statistics tool based on the counting of co-occurrences, the ALCESTE software. The structure of classes not indexed on different sensorial modalities highlights the specificity of representations in the chemical sense field through physiological studies.

In particular, the prototypical character of the representations is especially salient. These descriptive prototypes bear the mark of the preferences of wine tasters, rendering them highly individual. They are, above all, strongly indexed on the colour of wines. Moreover these prototypes integrate numerous non-sensorial dimensions, having a feature of the imaginary. The latter are assembled on equal terms with sensorial information in descriptive prototypes.

In the second part of this study we validated, with the help of psychophysical experiments, this specificity in perceptive representations. The influence of colour on the representations of fragrance and taste of the wine was clearly demonstrated, as was the interference generated by imaginary information. Finally, the hesitant and unstable character of the representation was confirmed on equal terms with high inter-individual variability.

Some of these particularities were finally examined through a study by IRM. The anchoring of representations not only in space but also in time was therefore clearly established. The cortical activation images also show a high disparity between subjects. Nevertheless the activation, highly lateralised in the right front sphere are systematic. They constitute the strong point of

perceptive representations of wine and more generally, chemical objects. During stimulation strong activation in associative zones were also observed. This lateralisation tends to bring a justification to the prototypical character of perceptive representations of chemical objects; at the same time as an implication of associative areas justifies the numerous interactions (called illusions for a long time) with the different senses (which is sometimes called synaesthesia) or more widely "cognitive elements" if imaginary, verbal notions are integrated.

The whole of these observations permit, from now on, not only a better understanding of wine tasting but also the proposal of a certain number of recommendations for its practice and teaching. In particular we owe it to ourselves to control the different sensorial entries, multi-criteria evaluation scales and based on prototypes should spread. As well, this work well justifies the immense differences observed by tasters between tastings in black glasses and tastings in transparent glasses on one hand, and on the other, those between blind tastings and "label seen" tastings. The perceptive representations which are the "perceived taste" are effectively very different and it is in vain to desire to compare the results obtained by one or another of these methods. Each has the right to its own supporters.

Nevertheless, the detailed mechanisms that preside over the elaboration of perceptive representations remain largely unknown to us. In what way may the stimulus sometimes be totally diverted by contextual or imaginary information? How are prototypes constructed in the perceptive field of the taster? In what way are certain representations consensual? Some of the questions that will interest us in the future, in the view to bring even more delight, as much to those who make wine as to those who drink it, all tasters!