Consumer preference for warm or cool climate wine styles is dependent on emotional responses and familiarity

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“Nothing more excellent or valuable than wine

was every granted by the gods to man."

Plato

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Abstract

The present work was aimed at the evaluation of a new wine tasting method based on emotional responses by a large consumer group. Subjects were characterized according to gender, smoking habits, wine knowledge, frequency of wine consumption, vinotype, 6-n-propylthiouracil (PROP) status and dark glass test. A total of 143 tasters evaluated 2 white and 2 red wines with different styles comprising emotional responses elicited by sensory perceptions. Consumers ranked the wines with a numerical scale (1 to 5) according to their preference and were asked about wine familiarity.

Overall, tasters provided higher liking scores for white and red wines consistent with the international commercial style, with high odour intensity and smooth mouthfeel, in opposition to wines with low smell intensity and aggressive mouthfeel. Global evaluation was only dependent on age, individuals younger than 35 years olds giving higher scores to all wines.

The Global Evaluation score was highly correlated with the mouth Impression in Relation to Odour (r^2=0.83) and with lower correlations with Expectation for the Mouthfeel induced by odour (r^2=0.52), Initial Odour Impression (r^2=0.50) and Colour Impression (r^2=0.25). Familiarity was moderately correlated with wine Global Evaluation (r^2=0.49).

Consumers were grouped based on the preferred wine styles. The “Primary” group (38 individuals) scored with 4 or 5 the international commercial style wines (“easy” wines), while the “Perceptive” group (16 individuals) gave scores of 4 or 5 to the cool climate wine styles (“difficult” wines). The largest group, the “Universals” was composed by individuals scoring these two wine styles with scores ranging from 1 to 5. The “Primary” group was characterized by showing responses of high pleasantness to colour, odour and taste to the “easy wines”, which were considered as familiar. The “difficult” wines were regarded as unpleasant and unfamiliar by this group. All wines were considered equally familiar by the “Perceptive” tasters who recognized the higher quality of the “difficult” wines. The “Universal” group behaved similarly to the “Primary” when tasting red wines, differing in equal preference for both white wines.

In conclusion, emotional responses elicited by wine tasting proved to be a powerful tool to explain wine consumer preferences thus providing guidance to the development of marketing strategies.

Key Words: wine tasting, wine preference, familiarity, emotional responses, cool climate wine

Resumo

O presente trabalho teve como objectivo a avaliação de um novo método de prova de vinhos baseado em respostas emocionais de um grande grupo de consumidores. Os indivíduos foram caracterizados quanto ao sexo, tabagismo, conhecimento de vinho, frequência de consumo de vinho, vinotype, estado de 6-n-propiltiouracil (PROP) e teste de copo preto. 143 provadores avaliaram 2 vinhos brancos e 2 vinhos tintos com diferentes estilos, avaliando respostas emocionais provocadas por percepções sensoriais. Os consumidores classificaram os vinhos com uma escala numérica (1 a 5) de acordo com a sua preferência e foram questionados sobre a familiaridade do vinho.

Em geral, os provadores atribuíram melhores pontuações de prova a vinhos brancos e tintos consistentes com o estilo comercial internacional, com alta intensidade aromática e sensação de suavidade na boca, em oposição a vinhos com baixa intensidade aromática e sensação agressiva na boca.

A avaliação da Avaliação Global foi altamente correlacionada com a Impressão da boca em relação ao odor (R^2 = 0,83) e com menores correlações com a Expectativa para a boca (R^2 = 0,52), Impressão inicial (R^2 = 0,50) e Cor (R^2 = 0,25). A Familiaridade foi moderadamente correlacionada com a Avaliação Global do vinho (R^2 = 0,49).

Os consumidores foram agrupados com base nos estilos de vinho. O grupo Primário (38 indivíduos) avaliou com 4 ou 5 vinhos internacionais de estilo comercial (vinhos fáceis), enquanto o grupo Perceptivo (16 indivíduos) deu notas de 4 ou 5 aos estilos de vinho de clima frio (vinhos difíceis). O maior grupo, os Universais, foi composto por indivíduos que pontuaram estes dois estilos de vinho com pontuações que variaram de 1 a 5. O grupo Primário caracterizou-se por apresentar respostas de alta agradabilidade à cor, aroma e sabor aos vinhos fáceis, que foram considerados familiares. Os vinhos difíceis foram considerados desagradáveis e desconhecidos por esse grupo. Todos os vinhos foram considerados igualmente familiares pelos provadores Perceptivos que reconheceram a maior qualidade dos vinhos difíceis. O grupo Universal comportou-se de forma semelhante ao Primário ao saborear os vinhos tintos, diferindo em igual preferência pelos dois vinhos brancos.

Em conclusão, as respostas emocionais provocadas pela prova de vinhos provaram ser uma boa ferramenta para explicar as preferências do consumidor de vinhos, fornecendo orientação para o desenvolvimento de estratégias de marketing.

Palavras-chave: prova de vinhos, preferência de vinhos, familiaridade, respostas emocionais, vinhos de clima frio

Resumo Alargado

O presente trabalho teve como objectivo a avaliação de prova de vinhos baseada em emoções. O painel de prova foi composto por 33 pessoas treinadas que foram caracterizados quanto ao género, hábitos de tabaco, conhecimento de vinho, frequência de consumo de vinho, vinotype, estado de 6-n-propiltiouracil (PROP) e teste do copo preto. Outras 110 pessoas não treinadas só fizeram a prova emocional.

As provas do painel treinado decorreram durante 4 meses, de Fevereiro a Maio de 2017, no Laboratório de Microbiologia, no Instituto Superior de Agronomia, enquanto que as provas do painel não treinado tiveram a duração de 2 meses, de Outubro a Novembro de 2017, no escritório da MBR Consultores.

Os quatro vinhos que foram usados na prova emocional tinham características e descritores muito diferentes. O primeiro foi um Gewurztraminer da Alsácia (1), o segundo foi um Chardonnay da Borgonha (2), o terceiro foi um Pinot Noir da Borgonha (3) e o quarto foi um vinho tinto encorpado - Opaco (4). Estes, podem ser classificados em vinhos fáceis ou difíceis, então o (1) e (4) são considerados vinhos fáceis, enquanto o (2) e (3) são considerados vinhos difíceis.

A ficha de prova emocional foi simplificada e baseada em trabalhos anteriores, com o objectivo de fazer uma análise mais objectiva e conclusiva. As categorias do provador em cada ficha de prova foram: nome, idade, sexo, hábitos alimentares, alergias alimentares, hábitos tabágicos, frequência, conhecimento, teste do copo preto, PROP, vinotype e treino.

Em cada parâmetro da prova, uma emoção específica é descrita e avaliada, usando 1 a 5 pontos em cada parâmetro. A ficha de prova emocional tem seis parâmetros no total: Cor, Primeira Impressão, Expectativa para a Boca, Avaliação da Boca - Impressão Relacionada ao Odor, Avaliação Global e Familiaridade.

Este trabalho é uma continuação e desenvolvimento de teses anteriores, também relacionadas com a emoção na prova dos vinhos. Foi utilizada uma ficha de prova, como anteriormente descrita, e a mesma tem como utilidade a facilitação entre enólogos e consumidores. A novidade desta ficha aborda a relação entre os descritores emocionais do vinho e as suas características emocionais. A tese tem como objectivos a avaliação de uma ficha de prova simplificada usando apenas perguntas de natureza emocional, na distinção entre vinhos de diferentes estilos, determinar a influência da familiaridade na avaliação global e determinar quais as características do provador que influenciam a apreciação global.

Relativamente à avaliação dos vinhos, em geral, os vinhos considerados fáceis (Vinho 1 e Vinho 4) tiveram melhores pontuações em todos os parâmetros emocionais. No descritor Cor, o Vinho 4 teve melhores pontuações comparativamente aos outros vinhos, independentemente de serem fáceis ou difíceis ou brancos ou tintos. Na Primeira Impressão, o Vinho 4 teve novamente melhores pontuações seguido do Vinho 1 e por fim do Vinho 2 e Vinho 3, ou seja, uma melhor pontuação para os vinhos fáceis. Assim como na Expectativa para a Boca, teve pontuações iguais face ao descritor anterior. Relativamente à Avaliação da Boca - Impressão Relacionada ao Odor e à Avaliação Global, é onde se nota mais a diferença entre os Vinhos 1 e 4 e Vinhos 2 e 3, tenho os Vinhos 1 e 4 muito melhores pontuações do que os Vinhos 2 e 3. Por fim, na Familiaridade o Vinho 4 teve melhores pontuações, seguidos pelo Vinho 1 e depois Vinhos 2 e Vinhos 3.

A avaliação da Avaliação Global foi altamente correlacionada com a Impressão da boca em relação ao odor (R^2 = 0,83) e com menores correlações com a Expectativa para a boca (R^2 = 0,52), Impressão inicial (R^2 = 0,50) e Cor (R^2 = 0,25). A Familiaridade foi moderadamente correlacionada com a Avaliação Global do vinho (R^2 = 0,49). Realizou-se também uma Análise de Componentes Principais (ACP) para corroborar os resultados dos coeficientes de determinação.

Na categorização do consumidor, os factores da idade, alergias, frequência, conhecimento, PROP e vinotype e o treino influenciaram as notas, enquanto que o sexo, hábitos alimentares, fumar e o teste do copo preto não influenciaram. Relativamente à idade conclui-se que em todos os factores emocionais, os provadores mais novos deram notas mais elevadas aos vinhos. Pessoas com alergias dão melhores notas na Cor e na Primeira Impressão. Relativamente à frequência de consumo de vinho, pessoas que nunca bebem vinho dão piores notas na Impressão em Relação ao Odor e na Familiaridade. No conhecimento, apenas as pessoas que se consideram novatas, só dão piores notas na Familiaridade. Relativamente ao PROP, os Non-Tasters dão piores notas na Impressão Inicial e na Familiaridade. No vinotype, retirando o factor da Familiaridade, todas as pessoas que não responderam ao questionário deram piores notas aos factores. Por fim, no treino, o painel não treinado deu piores notas na Cor, Primeira Impressão e Expectativa para a Boca.

Em relação à Familiaridade nos vinhos, mostrou-se uma clara tendência em todos os factores emocionais. Os provadores que deram boas notas na Familiaridade, também deram boas notas na Avaliação Global, e o contrário também se verifica. Ou seja, provadores que deram más notas na Familiaridade, em geral, deram piores notas na Avaliação Global.

Por fim, foram feitas três segmentações. Os consumidores foram agrupados com base nos estilos de vinho preferidos. O grupo Primário (38 indivíduos) avaliou com 4 ou 5 vinhos

internacionais de estilo comercial (vinhos fáceis), enquanto o grupo Perceptivo (16 indivíduos) deu notas de 4 ou 5 para os estilos de vinho de clima frio (vinhos difíceis). O maior grupo, os Universais, foi composto por indivíduos que pontuaram estes dois estilos de vinho com pontuações que variaram de 1 a 5. O grupo Primário caracterizou-se por apresentar respostas de alta agradabilidade à cor, aroma e sabor aos vinhos fáceis, que foram considerados familiares. Os vinhos difíceis foram considerados desagradáveis e desconhecidos por esse grupo. Todos os vinhos foram considerados igualmente familiares pelos provadores Perceptivos que reconheceram a maior qualidade dos vinhos difíceis. O grupo Universal comportou-se de forma semelhante ao Primário ao saborear os vinhos tintos, diferindo em igual preferência pelos dois vinhos brancos.

Em conclusão, houve uma clara diferença na percepção entre os vinhos fáceis e difíceis. O vinho 1 e vinho 4 tiveram melhores notas em todos os descritores emocionais do que o vinho 2 e vinho 3. Na Avaliação Global, a Impressão em Relação ao Odor apresentou o maior R^2 e a Familiaridade tem um papel fundamental na percepção dos vinhos. Relativamente a segmentação, a idade foi o factor mais diferenciador. Por fim, outro destaque para a familiaridade, um descritor emocional fundamental que necessita de um maior desenvolvimento e pesquisa.

Palavras-chave: prova de vinhos, preferência de vinhos, familiaridade, respostas emocionais.

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1. Introduction

1.1 The multisensory wine perception

Wine sensory analysis has largely been developed to answer to the need of describing, assessing and evaluating wines. The focus has been put on the ability of the tasters to describe sensory attributes elicited by visual, smell and taste/mouthfeel sensations. However, human senses are not accurate measures of these sensations due to physiological or cognitive limitations. Smell and taste sensitivities are dependent on individual genome and so different responses to the same stimulus are most like likely to occur (Hayes and Pickering, 2012). Cognitively, the same descriptor can be attached to two different sensory perceptions or the same sensory perception with two different words (Lesschaeve, 2006), while cultural background is decisive for the interpretation of semantics related with wine description.

The act of drinking involves directly the senses of sight, smell, taste and touch. These senses are simultaneously stimulated and so it is not easy to define how each of them influences wine perception (Small, 2012).

The visual evaluation of a wine should not influence the taster in relation to the quality of the wine, only if it has a defect. However, wine color, as it is the first factor to be evaluated, may alter the perception of a wine, including the aroma and flavour (Parr et al., 2003).

Aroma can be defined as “the property of certain substances, in very small concentrations, to stimulate chemical sense receptors that sample the air or water surrounding an aroma” (Illy and Viani, 2005). According to the ASTM, it is the “perception resulting from stimulating the olfactory receptors; in a broader sense, the term is sometimes used to refer to the combination of sensations resulting from stimulation of the nasal cavity” (ASTM E253-03). ISO does not give a unique definition, describing it as “an odour with a pleasant connotation” or “organoleptic attribute perceptible by the olfactory organ via the back of the nose within tasting” (ISO 5496:1992).

Our ability to sense odour is dependent on two, small, seemingly insignificant patches of tissue in the upper recesses of our nasal passages. Volatile compounds reach the olfactory epithelium either directly, via the nostrils (orthonasal), or indirectly from the back of the throat (retronasal). The latter route is especially important in the generation of flavour. The term orthonasal olfaction used for when we inhale, or sniff, while retronasal olfaction occurs when volatiles are pulsed out from the back of the nose while eating and drinking. Orthonasal olfactory cues are key to setting our expectations concerning the sensory and hedonic attributes of food and drink; by contrast, retronasal olfactory cues are central to the experience of flavour (Spence, 2016).

Flavour is by far the most debated term and it varies according to the field of research. It is primarily dependent upon reactions to taste and olfactory receptors to the chemical stimulus. However, some flavors also involve tactile, temperature and pain receptors (Beidler, 1958). Therefore, flavor is a multi-modal perception deriving from the activity of neurons that respond to inputs from different sensory receptors (Small, 2012). The receptive field for flavor is the mouth, where smell, taste and touch are pooled and transformed into flavor percepts (Small, 2012).

Flavour influences food acceptance and selection of food intake, and helps us to distinguish potentially harmful compounds. The taste sensation is a very complex process starting at the sensory receptor level and finishing in the central nervous system, where it is combined with information coming from other senses. The sense of taste is a chemical sense due to taste stimuli falling on taste receptors located on the tongue called taste buds (Jackson, 2014).

The gustatory sense produces the sensations of sweet, sour, salty, bitter, savory and umami. Taste is perceived through the oral cavity together with tactile sensations that always co-occur with taste (Small, 2012). The oral cavity also appears to be the source of olfactory stimuli, which are thus mis-localized. This perceptual illusion explains why the confusion between smell and taste is frequent and has been named as “oral referral” (Spence, 2016). This phenomenon is central to the multisensory flavor perception, being dependent on tactile capture of olfaction, the relative timing of olfactory and gustatory stimuli and gustatory capture (Spence, 2016). The more congruent a particular combination of smell and taste, the more likely the component unisensory stimuli will be bound together as a flavor object (Spence, 2016).

Mouth-feel is activated by free nerve endings, and gives rise to the sensations of astringency, dryness, viscosity, heat, coolness, prickling, and pain. The only textural aspect associated with wine is generated by the bursting of a sparkling wine’s bubbles. Their distribution throughout the oral cavity generates diffuse, poorly localized sensations. In wine, mouth-feel includes the perceptions of astringency, temperature, prickling, body, and burning. They derive from the stimulation of one or more of the (at least) four general categories of trigeminal receptors. These are mechanoreceptors (touch), thermoreceptors (heat and cold), nocireceptors (pain), and proprioreceptors (movement and position) (Jackson, 2014).

1.2 Tasting methods

1.2.1 Classical Methods

Classical methods for wine tasting have been developed and described since the works of Peynaud (1980) in France and of Amerine (1983) in USA. These methods are based on giving scores to wine sensory characteristics by filling tasting sheets. These sheets are used to train professionals not only in the academic and teaching parameters but are also seen as references by specialists and, despite its present diversity, there are only two major categories of wine tasting sheets: synthetic and analytic (Jackson, 2009). The former may be assessed holistically and/or hedonically, but they intend to evaluate qualitatively wines' characteristics, such as balance, complexity, specific varietal attributes or development. The latter tend to evaluate quantitatively the major sensory attributes (color, aroma and taste).

The various current descriptive methods derive from the method developed by Amerine and Roessler (1959), which comprises three stages: visual analysis, olfactory analysis and gustative analysis. This requires a great deal of training in the patterns of aromatic compounds, especially regarding the capacity for comparison, the memory of the sensations and the language in which they are expressed. This method requires three dimensions of the capacity for expression of sensation: physiological (perceptual capacity), psychological (perception and cognition) and sensory (perception and judgment) (Hederstam, 2009).

Due to the difficulty of expressing the sensations Noble (1984) and his team developed a terminology that was supposed to facilitate the communication about wine characteristics and eventual defects, based on terms used in the beer industry. The so-called wheel of aromas intended to standardise the description of the wines and set more objective parameters for the aromatic qualities. Also as a way of assisting in the learning process in wine tastings in the traditional method, "Le Nez du Vin" (Lenoir, 1981) was developed, which basically consists of a set of approximately 60 extracts isolated from the aromatic compounds that can be found in wines, separated by groups of aromas that can be found in white wines, reds, and defects, a tool that is used in the training of wine professionals as a way to standardize the descriptions.

Because it is based on perceptions, the classical descriptive methods require standardization, which takes some time to prevent a beginner from feeling confident in assigning sometimes unclear descriptors to wines. The traditional method is also widely used by all schools of sommeliers (International Association of Sommeliers - ASI), wine experts (WSET), opinion makers (Decanter Magazine, Wine Advocate - Robert Parker, Wine Spirits Magazine among others), and also adopted by the International Organization of Vine and Wine (OIV).

1.2.2 Limitations of sensory analysis and new methods

Control of the human aspect of sensory evaluation is one of the more difficult factors of sensory evaluation. This may be accomplished best by carefully selecting the people that will be participating in the test. Important qualities in a sensory panelist include availability, dependability, interest, objectivity, stability, and acute senses of smell and taste (Stone and Sidel, 1985, Hootman, 1992, Meilgaard, 1991).

The long lists of aromas often seen on tasting notes raise high expectations and bring disillusion to consumers who do not recognize or are not capable to identify all the aromas or flavours that are supposedly present in the wine. The general public would be reassured to learn that even experts using their sensory abilities in their profession, like perfumers, cannot detect more than three or four different fragrances in complex odour mixtures (Livermore and Laing, 1998, Jinks, 2001). It all brings some doubts about the use of the extensive lexicon created by the experts when it comes to communicating about the qualities of a wine to the consumers. The sensory analysis seems to create a communication gap between wine experts and consumers.

Unlike instruments, human judgements can easily be affected by psychological or physiological factors (Table 1.1). The sensory professional must be aware of these factors and ensure that the chosen procedure and experimental design eliminate or reduce such bias (Kemp, 2009). In addition, when working with assessors from different cultures or geographical location, the sensory professional needs to be aware of the impact that cultural effects can have on sensory data (Kemp, 2009).

Table 1.1. Human factors affecting sensory analysis (adapted from Kemp, 2009).

Psychological factors	Physiological factors
Errors due to: expectation, distraction, stimulus and logical, halo effect and proximity, central tendency and motivation Effects of: suggestion, order, contrast and convergence Attribute dumping, habituation, familiarity	Adaptation Perceptual interactions between stimuli Physical condition

Descriptive analysis is less suited for complex products especially when dealing with odours (Campo et al., 2010) as it is the case of wines. As a result of these limitations several alternative tasting methods have been developed that do not require description of flavours but are based on comparison with wine standards. Seminal reports described the Free Choice profile (Williams and Langron, 1984) and Repertory Grid (Thomson and McEwan, 1988) methods, which still require some training to improve taster reliability. To overcome these limitations, other approaches included Labeled Free sorting (Lawless et al., 1995),

Projective mapping (Risvik et al., 1994, Wilson et al., 2018), Napping® (Pagés, 2003), Flash Profile (Sierffermann, 2000), Ultra Flash Profile (Perrim et al., 2008), Check-all-that-apply (Adams et al., 2007), Polarized Sensory Positioning (Teillet et al., 2010) and Pivot© Profile (Thuiller et al., 2015).

This latter method seems especially suited for wine descriptions by professionals that are often reluctant to use classical sensory methods (Thuiller et al., 2015). To address this question of optimising the responses of professionals, Coulon-Leroy et al. (2017) proposed the Mixed Profiling method, combining Quantitative Descriptive Analysis ® and Free Choice profiling, which is claimed to provide a complete sensory wine characterisation in a short time. However, all these novel methodologies depend on sensory responses and require some sort of previous training. Another line of research has been developed where senses are an intermediate pathway to emotional responses, as described below.

1.2.3 Emotional Tasting

One of the aspects usually found to differentiate consumer responses to food product consumption, beyond liking, is emotional response. Studies carried out by Barrena and Sanchez (2009) and Silva et al. (2016) showed that consumers discriminate between products more for their emotional benefits than for their technical or functional properties. Therefore, the study of consumer preferences and emotional responses could provide solutions for making their products more competitive to the wine industry by using the emotional characterization of beverages as a new marketing tool to connect with consumers (Barrena and Sanchez, 2009, Silva et al., 2016). Also, it has been argued that the conventional hedonic response itself is not enough to explain consumers' response to products (Gutjar et al., 2013). Research conducted by Silva et al. (2016) found that emotions and liking were complementary for product characterization. However, while it is not always possible to differentiate products based on the degree of liking by the consumer, it is possible through the study of emotions.

Using emotions to differentiate between and within categories of food have proved to be significant (King and Meiselman, 2009). The emotional response to smelling odors is very complex and can be found in all the dimensions where olfaction plays a role, such as well-being, danger prevention, social interaction and memory (Chrea, 2009). For Desmet and Schifferstein (2008), emotions triggered by food can have 5 different sources: sensory properties, past experience, anticipated experience (such as anticipating health problems when eating unhealthy food), personal or cultural significance and third-party influence. Emotion is not a single response, but series of dynamic events that unfold over time (Sander,

2005). The temporal dominance of emotions (TDE) has shown, that during the consumption of 5 different chocolates, emotions, like sensations, were changing and evolving (Jager, 2014). A study also showed that some sensations and emotions were actually correlated thus providing some very interesting bases for more research that could help find a more sophisticated description of food products and wine (Jager, 2014). Ferdenzi (2011) used the methodology developed by (Chrea, 2009) to compare the emotional reactions to odour perception on the people of three countries with cultural differences (Switzerland, United Kingdom and Singapore). The dimensional organization of odour-related emotional attributes was significantly different from one country to another.

In wine, first studies described lists of emotional attributes elicited by wine on self-reported questionnaires (Ferrarini, 2010, Rive and Deneulin, 2014) and further reports highlighted the performance of consumers to distinguish between wines styles using emotional responses (Coste et al., 2015). Therefore, emotional responses not only bring new possibilities to differentiate wines, but also offer new perspectives of communication between experts and consumers.

1.3 Wine Styles

Wine style is a concept not easily defined by researchers and divulgation references frequently offer guidelines for the consumer to distinguish wines with different characteristics. For instance Puckette (2012) stated that wines can be separated by variety (e.g. Sauvignon Blanc or Syrah) or by region (e.g. Barossa or Bordeaux). This approach is said to be very accurate and learning demanding. This author further adds 9 broader styles which make learning about the thousands of wine varieties and regions much easier. The 9 primary wine styles are: Full-Bodied Red Wines, Medium-Bodied Red Wines, Light-Bodied Red Wines, Rosé Wines, Full-Bodied White Wines, Light-Bodied White Wines, Aromatic White Wines, Dessert and Fortified Wines and Champagne and Sparkling Wines (Puckette, 2012):

i) Full-Bodied Red Wines, typically have more tannin, higher alcohol, and dark fruit flavours such as black currant. Examples: Syrah, Cabernet Sauvignon and Malbec.

ii) Medium-Bodied Red Wines, in the middle of the gamut from light to full, medium-bodied reds are some of the best food-friendly wines. For instance, a Merlot from a hillside estate on Spring Mountain in Napa Valley will have high tannin and darker fruit flavours whereas a Merlot from a large valley vineyard in Lombardy, Italy will probably exhibit fewer tannins and soft red fruit aromas. Examples: Merlot, Sangiovese and Grenache.

iii) Light-Bodied Red Wines, delicately perfumed with very subtle flavours and light-bodied. Light red wines are known for having lighter tannin, bright acidity and slightly lower alcohol with red fruit flavours. Examples: Pinot Noir, Cinsault and Gamay.

iv) Rosé Wines, are the literal mid-point between white and red wine, however they tend to behave a lot more like a white wine. They are typically served chilled and many are dry. This style of wine is frequently produced in the Mediterranean around the south of France, islands in the Mediterranean, the Spanish eastern coast and in Italy. Examples: Garnacha Rosé, Provence Rosé and Côtes du Rhône Rosé.

v) Full-Bodied White Wines, these white wines typically undergo similar treatments as red wines in the winery to achieve the bold flavour, and thus have some flavour similarities. Typically, many rich whites undergo oak aging, to add that classic vanilla or coconut note, as well as a process called “Malolactic Fermentation”, which changes the type of acid in the wine to make wine taste creamier. Many full-bodied white wines will age up to 10 years, although most are in their prime at around 3-4 years. Examples: Oaked Chardonnay, Sémillon and Viogner.

vi) Light-Bodied White Wines, they are usually best enjoyed young, within a year or two of the vintage, to preserve the fresh fruity flavours and mouth-watering acidity. Examples: Albariño, Pinot Gris and Sauvignon Blanc.

vii) Aromatic White Wines, perfumed fruit and floral aromas. They are often (but not always) made in a style with some residual grape sugar. The sugar is there for balance, not just for the sweetness’s sake. Without retaining a little naturally-occurring grape sugar, many of these wines would be far too bitter or acidic for most drinkers. This style of wine is often referred to as, “harmoniously sweet”. Examples: Chenin Blanc, Gewustraminer and Riesling.

viii) Dessert and Fortified Wines, in order to preserve the natural sweetness in fortified wines, the fermentation is stopped before the yeast uses up all the sugar. Typically when you do this, you’d be left with a lower alcohol wine but since fortified wines are allowed to add spirits the wines are usually around 17-20% ethanol. Examples: Port, Sherry and Madeira.

ix) Champagne and Sparkling Wines, champagne bubbles come from the addition of a special mixture of sugar and yeast called the ‘liqueur de tirage’ to a dry, still base wine. The liqueur de tirage induces a second fermentation in the bottle; this makes the bubbles. Although, not all sparkling wines are made this way. Most notably Prosecco and Lambrusco are made by fermenting the wine in a tank under pressure and then bottling from there. Low-quality sparkling wines are often force-carbonated. Sparkling wines have bubbles

and high acidity and range from white, rosé to red in colour. Examples: Champagne, Prosecco and Cava.

Although differences may be found among the several wine styles the overall sensory profiles are very similar, suggesting that a certain wine style is systematically preferred by the competition tasters. According to Hopfer and Heymann (2014), there is an inclination of wine challenges to attribute the medals/awards to wines with no (or with very low concentrations) of vegetal, animal, chemical and/or earthy profiles. So, the standard of quality is set for wines with red berries, cherry, dominated by oak, with astringency and body. Consumer's taste becomes shaped in that direction. This is the wine type that most of normal consumers will like, since they have an intense smell but are not so mouthy strong.

Descriptors as bitterness or animal, reduction profile or minerality will give us a wine that normal consumers will reject, often saying that the wine is spoiled. Usually only trained individuals and wine experts know how to taste and appreciate these wine characteristics. Also, accordingly to Robinson (2018), there are two different wine styles nowadays. One is full-throttle, concentrated and makes an impression because of its mass. It's highly likely to have been made to resemble the sort of wine that was most admired in the 1990's. Ripe fruit is what it most obviously expresses. This style of wine was probably aged in oak, very possible, new barriques, and may well be based on one of the well-known international grape varieties such as Cabernet or Chardonnay. The other style of wine comes across nowadays what we might call "twenty-first century wine", a wine that's less ripe, higher in acidity, lower in alcohol, lighter in colour and weight, made from grapes picked earlier and finish with a little texture, something akin to wet stones or graininess. These wine are more likely to be made from indigenous grape varieties. A subsection of these new wines are natural wines, wines with a minimum of additions such as sulphites, sugar, tanins and acids.

1.3.1 Warm vs Cool Climate Wine Styles

Wine regions are grouped into two major climate types: Warm Climate and Cool Climate. Warm climate regions tend to have more consistent temperatures throughout the season. The slow drop off from summer into fall gives grapes ample opportunity to become fully ripe but the negative is that more natural acidity in the grapes is lost. Generally, warm climates produce grapes with more ripe fruit flavors and less acidity (Puckette, 2012). Cool climate regions definitely get just as hot as warm climates in the peak of the season. However, it is the fact that the temperatures drop off so quickly towards harvest that make the wines taste different. Lower temperatures preserve the acidity but they also make it

difficult for grapes to ripen. Generally, cool climate wine regions tend to produce tart fruit flavors and have more acidity (Puckette, 2012).

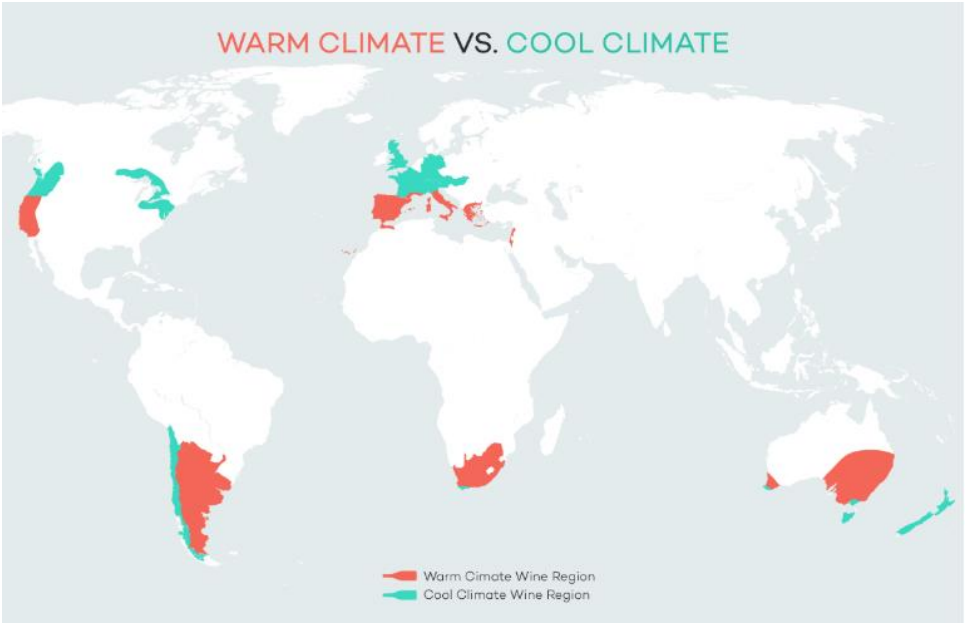

Figure 1.1. Warm Climate vs Cool Climate Map (Puckette, 2012).

1.4 Consumer segmentation

The sensory properties of wines are a major element that will determine success with consumers. It has been only in recent times that the wine industry and research community have started to apply the principles of sensory evaluation to quantify consumer preferences (Francis, 2015). The term “segmentation” includes all the procedures that aim to divide people into groups by using specific categories, such as gender, age, frequency, knowledge and training. Special attention should be given when it comes to create consumer/taster segments, as through this procedure we receive information about taste sensitivity and preferences as well. In particular, attention to consumer segmentation is essential when trying to understand taste sensitivity and preferences.

1.4.1 Demographic, physiological, psychological and cultural features

The most common distinctions are based on different categories linked with demographic, physiological, psychological and taste sensitivities. The segmentation can be achieved usually by simple demographic questionnaires (e.g. with questions aiming to know the

gender, age, origin, educational and cultural background, familiarity) as well as by tests and measurements of the taste functions.

1.4.1.1 PROP status

The ability to taste the bitter thiourea compound phenylthiocarbamide (PTC) as well as 6-n-propylthiouracil (PROP) is an inherited characteristic shared by approximately 70% of the US adult Caucasian population, the so called PROP medium tasters and supertasters (Tepper et al., 2001). The remaining 30% of the population receive PROP as weak or tasteless and they are called nontasters (Tepper, 2001).

Thioureas contain the chemical moiety N-C=S, which is responsible for its bitter taste (Bartoshuk, 1994). It is shown through past studies that PROP tasters (medium tasters and supertasters) generally perceive greater intensity than the nontasters, from a wide variety of compounds, such as caffeine, quinine, benzyl alcohol and many others (Tepper et al., 2001). Prop tasters are also known to show greater sensitivity to oral irritation from capsaicin, cinnamaldehyde and benzyl alcohol (Prescott, 2000). The ability to taste this compound is more common in women than in men (Whissell-Buechy and Wills 1989); therefore, women are supertasters more frequently and have more fungiform papillae and more taste buds (Bartoshuk et al. 1994). Also, according to Whissell-Buechy (1990), this ability is present in young children, declining slowly with age.

The PROP sensitivity evaluation procedure includes a tasting with 3 glasses with 20 ml of water solutions displayed in increasing order of concentration of the compound (6-n-propylthiouracil), 0.032 mM, 0.32 mM and 3.2 mM. The procedure is simple, requesting from the taster to evaluate in terms of intensity perceived, the bitter sensation of each concentration in a 100 mm general Labeled Magnitude Scale (gLMS) and are following classified through the score given to the 0.32 mM solution (Non-taster ≤ 15.5 mm; 15.5 < Taster < 51 mm; Super-taster ≥ 51 mm) (Pickering, 2004).

1.4.1.2 Familiarity and Neophobia

Personality factors are often not investigated simultaneously with taste phenotypes. However, evidence suggests that personality factors might influence food liking and/or intake (Goldberg and Strycker 2002). One such factor, willingness to try new food and beverages, varies across individuals and is often conceptualised as food ‘adventurousness’ or ‘neophobia’.

In a general approach, there is a coexistence between a demand for modernity and naturalness regarding diet and food, including the need for novelty (neophilia) as well as caution, concerning new, unknown food (neophobia) (Coppola, 2014) as well as, in our case, particular styles of wine. It is known that there exists a population of individuals who are hesitant to try new wines, such as biodynamic wine, wines originating from other countries or even continents, wines with different, innovative and sometimes unfamiliar with the tasters ways of production.

It's understandable that cultural variables may play an important role in influencing responses to new styles or foreign wines. The educational background, age, gender and many other social-demographic factors could have an impact on how willing the people are to taste new wines (Higgins, 2015). This wine “neophobia” should be overcome through repeated development of knowledge, informing and promoting a global and friendly tasting environment.

Expert knowledge representation seems to be acquired through both exposure and intensive formal training, leading to the development of skills and conceptual knowledge in a specific field, associated with many years of experience (Honoré-Chedozeau, 2017). In this context, familiarity is defined as ‘the number of product-related experiences that have been accumulated by the consumer and expertise as ‘‘the ability to perform product-related tasks successfully. So, on the path to becoming an expert, familiarity seems to be a compulsory step in the learning process (Park et al., 1994).

Brand familiarity is a function of the number of indirect and direct product-related experiences with a particular brand, and is regarded as crucial to predicting consumer behaviour: with familiar brands thus possessing significant communication advantages since they can be recognized more easily than their lesser cousins (Delgado-Ballester et al., 2012).

By extension therefore, familiar brands receive benefits in terms of increased consumption and greater perception of quality (Labroo and Lee, 2006). So in wine purchasing behaviour, brand familiarity and price were found to be the most important factors determining consumer choice.

In blind tests, individual may rely only on the intrinsic properties inherent in the wine itself. This being so, through the consequent control of blind measures of quality, the influence of a particular brand cue on any subsequent sighted assessment may thus be flagged and computed, in conjunction with the potentially mediating effects of one’s declared familiarity, exposure and knowledge of the brand in question (Prillaid et al., 2017).

1.4.1.3 Expertise and training levels

One way of exploring knowledge representation is to compare expert and non-expert panels. Expert knowledge representation seems to be acquired through both exposure and intensive formal training, leading to the development of skills and conceptual knowledge related to a specific field (Honoré 2017). Prior work suggests wine knowledge and sensory ability may together constitute a measure of wine expertise (Frost and Noble 2002). In turn, it would be expected that wine expertise associates with overall liking of wine (presumably high liking is an important motivator in becoming a wine expert) and intake. Wine experts have been shown previously to possess better olfactory recognition than novices (Parr 2004). The high specialization of descriptive panels allows obtaining very detailed, robust and consistent, reproducible results, stable in time and within a certain sensory space (Moussaoui and Varela, 2010).

Thanks to a common descriptive language and their significant knowledge of wine characteristics, it has been demonstrated that wine experts can perform sensory description without previous common training because they share a common descriptive language (Maitre et al., 2010). Secondly, the generation of descriptors by the panel is classically solved by the use of a list of descriptors pre-defined by the panel leader. So, to have a trained and non-trained wine tasting panel, is as much as important as the saliva flow rate, PROP, sweet liking, in order to have a more complete and true taster segmentation.

1.4.2 Segmentation based on wine style preference

1.4.2.1 Factors affecting wine choice

From a sensory science point of view, increased attention has been given to the interaction of sensory and non-sensory factors in the last decade, since in a real purchase situation people rarely choose or consume an unidentified food product (Francis 2015). Packaging information, such as brand and price, can raise expectations, which can prompt product choice (Deliza and Macfie 1996). When the product is finally consumed, the expected sensory attributes will be confirmed or disconfirmed, either raising or lowering consumers' expectations. Strong expectations can override sensory experience in some cases, especially for consumers who are less familiar with the product category. The price of the wine has been shown to change the way consumers experience it, not only increasing sensory acceptance, but actually making them happier, with the activity of a brain region involved in the experience of pleasure becoming stronger when the drinker thinks that the wine is more expensive (Plassmann, 2008). Deliza and Macfie (1996) emphasise the importance of sensory attributes for consumers, who will learn from previous experiences with the product and might change their purchase choice depending on the quality of the product on each purchase.

Consumer preferences regarding foods and brands are constantly changing, dictated by trends and the influence of the mass media. Consequently, companies have to adapt their products to these changing preferences if they wish to position themselves as market leaders. The wine market is similar in this respect, and wine consumers' preferences also change according to trends or critical opinions (Perez-Magariño, 2010). However, wine consumers choices are more complex than that of many other products. This fact is due to the high number of attributes, both intrinsic (involving physicochemical composition, directly related to the product) and extrinsic (which can be altered without changing the product), that may influence the buying decision. Several factors and attributes that affect wine choice. The most important of which are the type of wine, price, quality certification, grape variety and commercial brand. This indicates that wineries have to be innovative and produce the wines that consumers demand, or introduce 'new' products in order to extend their range or capture new consumers (Perez-Magariño, 2010).

Application of sensory science to characterise the sensory properties of wines, with intensity of multiple sensory attributes generated by a trained panel, followed by consumer hedonic tests carried out under controlled, blind tasting conditions, means that the particular appearance, aroma and flavour attributes, and their strength, can be related to consumer preference or liking (Francis and Williamson, 2015). The first study published utilising this technique in wine research (Yegge and Noble, 2001) demonstrated the great wealth of information arising from combining trained panel sensory analytical data – quantitative intensity ratings of specific appearance, aroma and flavour attributes conducted in replicate, with consumer acceptance data obtained from a relatively large number of untrained consumers selected based on wine consumption and demographic information.

Regarding white wines, it has been found (Table 1.2) that there are substantial differences in liking responses amongst white wine consumers for different sensory attributes of wines. A common finding across several studies is the importance of acidity for many consumers together with bitterness for a smaller number of studies. Sweetness was also found to be a key attribute. The role of bitterness was indicated as generally a negative attribute for a sizable proportion of consumers in several studies. An oak/fruit continuum has also been found repeatedly, with moderate oak being generally a positive influence on liking, while high oak or no oak flavour can be polarising. Fruit intensity and type were also prominent attributes (Francis and Williamson, 2015).

For red wines, there were also common responses across multiple studies (Table 1.3) The importance of berry fruit and strong fruit flavour, as opposed to relatively high sourness or

bitterness, was evident for many consumer clusters. Sweetness was also a key factor and the presence of 'Brett'-related flavour was a common negative driver of liking, as were sulfur-related flavour, oxidation-related flavour, and 'green' or vegetal flavour. The presence of 'green' aroma/flavour, however, was not invariably a strong negative driver for all consumers, but those who appreciated wines with this flavour attribute were in the minority for most studies. The attribute 'hotness' or warmth was not usually an important feature influencing preference, indicating that alcohol level per se is not necessarily a key attribute driving consumer acceptance. Astringency is an interesting attribute, as it is sometimes indicated as a negative attribute for clusters of consumers, separate from bitterness. Finally, aged flavour, as indicated by lower fruit attribute ratings or by the attributes leather or earthy, was not generally a character that consumers appreciated (Francis and Williamson, 2015).

In summary, these studies in tables 1.2 and 1.3 highlight the proportion of consumers appreciating and responding to different key attributes of white and red wines.

Table 1.2. Sensory attributes of white wines found to be related to liking for cluster of wine consumers from preference mapping studies (Francis and Williamson, 2015)

Study details	Consumer group	Attributes related to liking	
		Positively related	Negatively related
Ten 'inexpensive' California Chardonnay wines, 126 consumers (Yegge and Noble 2001)†	Cluster 1 (25%)	Floral aroma	Oak
	Cluster 2 (14%)	Oak, peach/apricot	Floral
	Cluster 3 (25%)	Moderate oak, moderate apple or peach/apricot	Floral, astringency
12 international Chardonnay wines, <$US15, 361 consumers (Lésschaeve et al. 2002)	Cluster 1 (moderate proportion)	Alcohol, spicy/smoky oak, lingering aftertaste, sour, dry, bitter	Sweet, fruity, berry, smooth
	Cluster 2 (low proportion)	High overall flavour, sweet, vanilla, toasted oak	Sour, bitter, dry
	Cluster 3 (moderate proportion)	Moderate sweetness, sourness, low-moderate oak flavour	High flavour
	Cluster 4 (high proportion)	Sweet, smooth, fruit	Acid, bitter, dry
12 white wine blends, $CAN6–8, 115 consumers (Lésschaeve and Findlay 2005)	Cluster 1 (18%)	Alcohol burn, banana aroma	Earthy, musty, oak
	Cluster 2 (18%)	Sour, bitter, earthy, vanilla, oak	Smooth, sweet, melon, banana
	Cluster 3 (33%)	Smooth, sweet, melon, banana	Acid, bitter, earthy, vanilla, oak
	Cluster 4 (31%)	Alcohol, apple, tropical fruit and pear aroma	–
14 white wines: Riesling, Chardonnay, Pinot Gris, $A8–20, low sugar, 203 consumers (Francis et al. 2010)	Cluster 1 (41%)	Oak, alcohol heat, butter, viscosity	Citrus
	Cluster 2 (22%)	Citrus, acidity	Oak
	Cluster 3 (36%)	–	Bitterness, sourness, astringency
Ten Sauvignon Blanc wines, $US6–20, 109 consumers (Lund et al. 2009)	Cluster 1 (77%)	Fruity (stone fruit, passionfruit, box wood), capsicum, asparagus	–
	Cluster 2 (23%)	Flinty/mineral, bourbon	–

Table 1.3. Sensory attributes of red wines found to be related to liking for clusters of wine consumers from preference mapping studies (Francis and Williamson, 2015)

Study details	Consumer group	Attributes related to liking	
		Positively related	Negatively related
12 red wines $US7–13, 57 US consumers (Frøst and Noble 2002)	Total sample	Berry, fruity, butter, vanilla/oak, canned vegetables, green olive	Sourness, leather
12 Cabernet Sauvignon and Shiraz wines, $A9–28, 203 Australian consumers (Lattey et al. 2010)	Cluster 1 (15%)	Sweetness, caramel, fruit flavour	Sourness, green flavour, earthy, barnyard, band-aid, metallic
	Cluster 2 (19%)	Green flavour, blackcurrant, mint, fresh green	Bitterness
	Cluster 3 (21%)	–	Pepper, woody, brown
	Cluster 4 (45%)	Floral, confectionary, moderate astringency	Smoky, woody, sourness
14 red wines, $A6–19, 310 Chinese consumers, 216 Australian consumers (Williamson et al. 2012)	Cluster 1 (Chinese, 49%)	Sweet, fruit aftertaste, red fruit	Purple colour, dark fruit, black pepper, viscosity, oak, sourness, bitterness
	Cluster 2 (Chinese, 31%)	Sweetness, red fruit, confectionary	Fresh green, sour, bitter
	Cluster 3 (Chinese, 20%)	Dark fruit, purple colour, viscosity, black pepper	Brown colour, astringent, bruised fruit
	Cluster 1 (Aust., 38%)	Sweetness, red fruit	Sourness, bitterness, fresh green
	Cluster 2 (Aust., 23%)	Oak, alcohol, colour intensity, brown tint, astringency	Fresh green, red fruit
	Cluster 3 (Aust., 39%)	Alcohol aroma	Astringency, bruised fruit, earthy/veg., earthy/barnyard
20 Australian Shiraz wines, $A9–26, Sydney consumers ($n = 100$ per wine, 420 total), informed (Mueller et al. 2010)	Total sample	Sweetness, fresh fruit, oak	Earthy/veg., sherry (bruised fruit), medicinal, egg, vanilla/chocolate, astringent
Eight red wines (four Italian, four American), 106 Californian, 92 Italian consumers (Torri et al. 2013b)	Total sample and Cluster 4, Italian (15%)	–	Leather, earthy, band-aid, medicinal

1.4.2.2 Examples of segmentation based on wine style preference

The literature mentions several attempts to understand wine preference by consumers, some of which are described below.

Hanni's segmentation

The vinotype test is an online wine personalization test (www.vinotype.com) which is principally based on the preferences of the individuals, launched in 2011 (Hanni, 2012). The developer of the vinotype test was Tim Hanni, an American Master of Wine, whose objective was to help consumers find out more about their own preferences. Hanni (2012) takes a phenotypic approach, which demonstrates that all organisms can be categorized into phenotypes, that in the case of individuals, the phenotype is the composite of the individual's observed properties, characteristics and traits (Borchgrevink and Sherwin, 2017).

In sum, the phenotypic approach suggests that individuals develop (behavioral, food, entertainment) preferences over time based on their experiences and interaction with their broader environment (Borchgrevink and Sherwin, 2017). Adapting the phenotypic approach

to the world of wine and wine preference, Hanni (2012) proposes the use of vinotype, defined as “The set of observable characteristics of a wine-imbibing individual resulting from the interaction of its genotypic sensory sensitivities in a wine-related environment”.

The Vinotype assessment consists of various questions that determine the sensory sensitivities and tolerances combined with questions that determine certain elements the taster values about wine. The result is the taster Vinotype – the unique combination of sensitivities and values that comprise wine personal preferences. The possible four results are: Sweet, Hypersensitive, Sensitive and Tolerant.

Table 1.4. Categories of Vinotype personalization test (adapted from Hanni, 2013 and Borchgrevink and Sherwin, 2017)

Vinotype	Description
Sweet	Greater preference to sweet foods and/or fragrant sweet wines with low alcohol Preferred wines: Chardonnay, Moscato, Pinot Noir, Riesling, Sangria, Sparkilings Higher number of tasting buds More likely to be women (approximately 21%) and 7% men
Hypersensitive	Greater preference to lower alcoholic content wines, delicate dry or off-dry, aromatic and smooth wines Preferred wines: Blush/Rose, Chardonnay, Gamay, Pinot Grigio, Pinot Noir, Riesling, Sparklings Intense sensory experiences About 38% of women and 36% of men
Sensitive	Largest segment Widest range of wine preferences, willing to try new flavors and styles Preferred wines: All styles Tendency for delicate or full-bodied wines, dry whites and rich reds About 25% men and women
Tolerant	Preference for more tannic, powerful, full-bodied reds, intensity and high flavor in whites Preferred wines: Cab. Sauvignon, Malbec, Pinot Noir, Sauvignon Blanc, Syrah Willing to try wines with higher alcohol Approximately 16% of women and 32% of men

Hughson´s segmentation

Accordingly to Hughson (2012) there are four different segments based on wine consumer preferences:

Segment 1 (‘Elaborates’). What stands out is that they like wines that generate a range of sensations. The sensations even include ‘fizzy’, which was a significantly negative element for participants as a whole. It is important to note that the expected liking rating for the

‘Elaborates’ is relatively small suggesting that this segment have low general interest but are especially susceptible to product attributes.

Segment 2 (‘Classics’). These individuals are only interested in traditional wine styles. Any wine that is different from that detracts from overall acceptability. This is especially evident in the high negative utility values for the fizzy and sweet wines. This group made up the largest proportion of both the red and white-wine samples.

Segment 3 (‘Imaginers’), appear to enjoy the emotional and brand benefits such as the celebratory, traditional and natural elements of wine. Brand as well as some classical wine descriptions also add to acceptance. The expected liking rating is also quite small suggesting that while general interest is low, these subjects are also particularly susceptible to product features.

Segment 4 (‘No Frills’), appear interested in a simple wine that will not cause them any trouble and is easy to drink. This segment also finds especially complex descriptions, brand and premium quality detract heavily from the acceptability of a wine. In fact, the higher utility values for the negative over positive attributes show that any additional elements are more likely to detract from than increase product acceptability. This is also illustrated by the high additive constant. Notably, this segment only makes up 11 % of the red wine respondents.

Loureiro’s segmentation

In a simple but very systematic manner, Loureiro et al. (2016) considered only two consumer segments according to the preference for two wine styles, the first named as “Easy” wine likers and the second as “Difficult” wine likers. The table 1.5 summarizes the typical comments that an average consumer will give to an “easy” wine versus a “difficult” one when tasting without previous training.

As a consequence, when consumers and experts taste together in wine challenges, a higher score will most likely be assigned to wines with intense fruity-oaky smells and full, smooth mouth-feel (Loureiro et al., 2016).

For example, classic cool climate wines are typically defined as aggressive and fail to be recognized as of high quality standard by untrained consumers. Having this in mind, Loureiro et al., (2016) described a new tasting approach based on emotional reactions in order to facilitate the understanding of these difficult wines among consumers, and was improved by Coste et al., (2018) using wines that represent easy and difficult wines, both white and red.

Table 1.5. Typical comments from an average consumer in a wine tasting (adapted from Loureiro et al., 2016).

Parameters	Easy Wines		Difficult Wines	
	White	**Red**	**White**	**Red**
Visual	Light yellow color	Deep red color	Dark yellow	Light red
Intensity of the smell	Intense, fantastic, appealing		Discrete, smells badly, it stinks!	
Dominant smell	Flowery, fruity, sweetish smells, Happiness to recognize!		Difficult to describe, vegetal, earthy, "harsh". Unhappy for not recognizing.	
Evolution	Stable		Changes favorably	
Expectations for the taste	High expectations		Low expectations	
Feelingsafter tasting	Disappointing, it disappears!		Surprisingly good, it is tasty!	
Dominant perception	Sweet		Acid, salty, bitter	
Mouth-feel	Smooth, hot, nice!		Irritating, chilly, aggressive and harsh!	
Overall preference	High		Low	
Reassessment	Smells and tastes the same		Improved with time, it's another wine!	
Final conclusions	Simple, short and smooth. Easy to understand.		Complex, persistent and vibrant. Requires learning and time.	

1.5 Background and Objectives

This work is a continuation and improvement of previous thesis related to wine tasting based on emotions accomplished by Brasil et al. (2016), Coste et al. (2018), Almeida (2017) and Manataki (2017).

An empirical emotional wine tasting sheet was created by Brasil et al. (2016), including emotional responses and sensory attributes. It was made with 14 attributes, both emotional and technical. This approach linked emotional descriptors with wine sensory characteristics. This empirical tasting sheet was subjected to improvement using a Focus Group approach where several changes were made and tested using a large consumer tasting (Coste et al., 2018), This author reached to the conclusion that it would also be particularly interesting to organize a tasting where participants would have to taste the wine and give a global evaluation. That would help to understand how the global evaluation could be biased by a single descriptor and possibly see which descriptors would be more influential (Coste et al.,

2018). This sheet was further tested with a different tasting panel by (Almeida, 2017). A comparison of the main correlations between the 14 descriptors of the tasting sheet showed that the emotional descriptors most relevant for wine discrimination were: Colour Impression, Initial Odour Impression, Expectation for the Mouthfeel, Impression in Relation to Odour and Global Evaluation (Table 1.6). Then, it would be interesting to check if these emotional responses could efficiently distinguish wines from different styles. Additionally, the proposed tasting approach depends on the use of wine standards to illustrate the descriptors under assessment. For instance, complexity and persistence were evaluated by comparison with blended wines with high and low scores for those attributes. It would be a challenge to check if consumers without any previous training and wine standards could provide responses that could be explained by wine characteristics.

In parallel, Manataki (2017) concluded that the majority of the respondents were not willing to try particular styles of wine, showing their doubts and distrust among new and innovative ways of producing wine, or even wines from different cultures. These observations are related with the "neophobia" concept which was evaluated under the notion of Familiarity.

Table 1.6. Main correlations between variables of the emotional tasting sheet.

Variables	Colour Impression	Initial Odour Impression	Expectation for the mouthfeel	Impression in Relation to Odour	Overall Taste Evaluation	Reference
Expectation for the mouthfeel	0.45	0.79	-	Ns[b]	Ns	Coste et al. (2015)
	0.38/0.39[a]	0.68/0.69	-	0.42/0.21	0.02/0.06	Almeida (2017)
Overall Taste Evaluation	Ns	0.49	0.48	0.63	-	Coste et al. (2015)
	Ns	Ns	Ns	Ns	-	Almeida (2017)
Global evaluation	Ns	0.55	0.55	0.64	0.80	Coste et al. (2015)
	0.29/0.27	0.55/0.41	0.57/0.27	0.68/0.61	0.16/0.04	Almeida (2017)

[a] Results from the trained/untrained panel.
[b] Ns, non significant.

Therefore, the present work had the following objectives:

- To evaluate a simplified tasting sheet using only emotional questions to rate wines with different styles;
- To determine the effect of taster characteristics on global wine evaluation;
- To determine the influence of familiarity on the global wine evaluation;
- To determine the preference for cool or warm climate wine styles.

2. Material and Methods

2.1 Taster Selection and Training

The tasting panel was divided by two groups. A trained tasting panel and a non-trained tasting panel. The trained tasting panel was mainly selected among the students of the Master of Viticulture and Enology of Instituto Superior de Agronomia (2016/2017). First and second year students were the main targets of the work. The selection has been concluded in order to find the subjects with the best knowledge and sensitivity about the main descriptors of the mouthfeel: acidity, saltiness, sweetness and bitterness with the purpose to have a group of trustable people in the results and trained to perceive differences.

Thirty-three subjects (20 females and 13 males, between 19 and 41 years (average 24.6) were selected. All sessions took place in the laboratory of Microbiology of ISA and lasted approximately four months, from February to May of 2017, applying from one to three different tests each week, depending on time flexibility and materials. The goal was to find out subjects that consume usually wine at least once a week and were able to distinguish the samples submitted. They were prepared highlighting the main mouth-feel perceptions.

Training began by the evaluation of prototypical tastes (sweet, acid, salt, bitter) and astringency. Several tests were done to select the tasters. The objective of these tests was to determine if the tasters were able to detect the simple tastes. In addition, adaptation to scale utilization was performed by rating several sensations experienced at least once in their life, concerning pain, tastes, and senses.

After the training, the trained tasting panel did a emotional wine tasting with a proper sheet, indicating their names, age, gender, if they are vegetarians, if they have allergies, smokers or non-smokers, weekly frequency of wine tasting, the knowledge on wine tasting, the black glass test, the PROP sensibility test, vinotype and the emotional responses to wine consumption.

The non-trained tasting panel was selected between people of all ages and occupations, in order to have a heterogeneous group of people. One hundred and ten subjects (50 females and 60 males, between 19 and 66 years (average 38.8 ±14.2) were selected. The sessions took place in the laboratory of Microbiology of ISA (30 tasters), in the office of MBR Consultores (48 tasters), at Torre de Palma (Monforte) Hotel (23 tasters) and at Pousada de Alcácer (9 tasters) and lasted approximately two months, from the beginning of October to the end of November of 2017.

This non-trained tasting panel was only subject to the emotional wine tasting test.

2.2 Taster characterization

2.2.1 Questionnaires

Participants were asked to complete a brief questionnaire that collected basic demographic data (age, gender, nationality, education background). Their wine knowledge was obtained by endorsing the following items: I don't drink wine; beginner; intermediate; very high (annex 1a.)

2.2.2 Vinotype

Vinotype is an online test (www.myvinotype.com) based on the individual's wine preferences (Hanni, 2012). It assesses individual taste sensitivities and tolerances and helps the consumers to learn more about their own preferences. The vinotype is the sum of physiological and psychological factors that determine wine preferences and values. The procedure is quite simple, containing short questions that will give the final characterization of the applicant. The possible four results are: Sweet, Hypersensitive, Sensitive and Tolerant (annex 1b.)

2.2.3 PROP

PROP status was assessed in duplicate during two 15 minutes sessions in two different days, used firstly by (Pickering et al., 2004). Participants rated the bitterness intensity of three PROP solutions (0.032, 0.32, and 3.2 mM) in a increasing order of concentration. Individuals were given 20 ml of solution in each glass and instructed to move the sample in the mouth, for 10 seconds, covering all the mouth surfaces and wait for the sensation intensity to peak (10-15 s) and to expel the sample. After 10 to 15 seconds they rated the intensity of the sensation by drawing a mark on a gLMS Scale. The gLMS Scale uses a "barely detectable" on the bottom (0 mm) and a "strongest imaginable" (100 mm) on the top (Bartoshuk, 2000).

To help assess the PROP Status another tasting was performed. Participants rated the intensity of three sodium chloride solutions (0.01, 0.1, and 1 mM) in a increasing order of concentration. The procedure was the same used for the PROP solutions.

Tasters were classified as non-tasters and tasters based in the bitterness rating to the 0.32 mM PROP solution using the gLMS Scale (non-taster: ≤ 15.5; taster: ≥ 15,5 and < 51; super tasters ≥ 51; (Tepper et al., 2001).

Subjects were trained in the use of the general labeled magnitude scale (gLMS) following published standard procedures (Bartoshuk, 2000) that involved culturally appropriate remembered or imagined sensations. The gLMS is a psychophysical tool that yields high quality, ratio level data (Bartoshuk, 2000). It requires subjects to rate their perceived intensity of a given stimulus along a line scale with adjectives at empirically derived intervals. The 100 point scale comprises the following adjectives: no sensation= 0, barely detectable=1.5, weak=6, moderate=17, strong=35, very strong=52, and the strongest imaginable sensation of any kind=100 (Bartoshuk, 2000). The scale presented to subjects shows only the adjectives, not the corresponding numbers. The score, in cm, for each of the intensity measures was manually obtained with a ruler (annex 1d.)

2.2.4 Test of the dark glass

The subjects were presented a black glass, so they could identify if it was white or red. Between tasters, the variety (between white and red) was interleaved, so that the tasters that were next to eachother wouldn't have the same wine. The wines that were used were Casal da Eira, white and red, a commercial cheap wine, because the only objective was to see if the panel could identify them.

2.3 Emotional Tasting

2.3.1 Wines

In the emotional tasting were used four wines, two whites and two reds, each one with different characteristics and pronounced differences. All of the above have international gold medals and good reviews by specialists and consumers.

The aim was to choose very distinct wines (both white and red) for the tasters to compare in the tasting.

In this emotional tasting, there are warm and cool climate wine styles. Wine 2 (Chardonnay, Bourgogne) and Wine 3 (Pinot Noir, Bourgogne) are considered cool climate wine styles, while Wine 1 (Gewurztraminer, Alsace) and Wine 4 (Opaco, Casa Santos Lima) are considered warm climate wine styles. Although Wine 1 is from a cool region, it can be a considered a warm climate style because of their aromatic intensity, very perfumed and the lack of acidity.

The first and fourth wines were "easy" with a more aromatic nose, and a round mouth, and the second and third, more "difficult", not so lush and more complex.

Their main technical and sensorial characteristics are presented in table 2.1 and 2.2.

Table 2.1. Brand and technical characteristics of the wines used in the emotional tasting.

Wine	W1	W2	W3	W4
Producer/	Joseph Cattin	Louis Latour	Albert Bichot	Casa Santos Lima
Brand	-	-	Vielles Vignes	Opaco
Country	France	France	France	Portugal
Type	Dry white	Dry white	Dry Red	Dry Red
Grape Varieties	Gewurztraminer	Chardonnay	Pinot Noir	Sousão and Alicante Bouschet
Vintage	2015	2015	2008	2015
Denomination	Alsace AOC	Bourgogne, 1er Cru	Bourgogne AOC	Regional Lisboa
Alcohol	13% (v/v)	13% (v/v)	12.5% (v/v)	14% (v/v)

Table 2.2. Sensorial characteristics of the wines used in the emotional tasting.

Wine	W1	W2	W3	W4
Colour	Light and pale gold	Light and pale yellow with green hues	Light and very pale red	Loaded and opaque colour, with intense violet tonality
Nose	Very perfumed and aromatic on the nose, with sweet and floral and tropical notes	Fresh on the nose with stone fruit aromas	Subtle, with fruity aromas such as blackcurrant, plums and raspberries with a hint of spices	Very expressive, with rich aromas of ripe black fruit, chocolate and very intense wood notes
Mouth	Floral and citrus notes, but it lacks a little bit of acidity and very fruity and dry	Round on the palate, fresh almond notes, with crisp acidity, nice minerality and a round final	Very fruity, flavours of dark cherries and fruits, balanced tannins, with a medium-long aftertaste, not much body but with a crisp good acidity	Black and red fruit and wood aromas, with ripe tannins and intense body and a persistent finish

2.3.2 Emotional Sheet

The tasting sheet (figure 2.1) was based on a previous one described by Brasil et al. 2016) and Coste et al. (2018), and taking in consideration the emotional dimension in a wine tasting. This tasting sheet was improved and simplified relatively to the emotional sheets made by the students of the master's degree in viticulture in oenology, which approached the theme of thesis related to the emotional responses in wines.

This simplification was made due to the results and conclusions drawn by previous studies, thus being able to evaluate the parameters with greater significance and to be able to make a more objective and conclusive analysis (Almeida, 2017).

In each parameter of the tasting, a specific emotion is described and evaluated, using a 1 to 5 score in each parameter. The emotional sheet has six parameters in total. It started with the visual evaluation, where the taster rates the colour of the wine from 1 to 5: Dislike (1) to Really Like (5). After, the nose evaluation (olfactory) was divided in two parameters. Firstly, the initial impression: Dislike (1) to Really Like (5), and then the expectation for the mouth: Low (1) to High (5). The fourth evaluation was related to the mouth evaluation (gustatory), and it was related to the nose evaluation, the impression related to the aroma: Disappointing (1) to Surprisingly Good (5).

In the time following these parameters, it was asked to rank the wines (Global Evaluation), from: Don't Like It At All (1), Don't Like (2), Indifferent (3), Like (4) and Really Like (5). To conclude, the tasters had to answer what was the Degree Of Familiarity With The Type Of Wine: Never Tasted (1), Reminds Me Of Something (2), It's Not Stange To Me (3), It's Familiar (4) and It's Very Familiar (5).

The original Portuguese version is on annex 1i.

Emotional Tasting Sheet		**Wine 1**	**Wine 2**	**Wine 3**	**Wine 4**
Visual Evaluation					
Colour Impression	Dislike(1) Really Like (5)				
Nose Evaluation					
Initial Odour Impression	Dislike (1) Really Like (5)				
Expectation for the Mouthfeel	Low (1) to High (5)				
Mouth Evaluation					
Impression in Relation to Odour	Disappoiting (1) to Suprisingly Good (5)				
Global Evaluation					
Don't Like It At All (1) to Really Like (5)					
Degree of Familiarity with the Type of Wine					
Never Tasted (1) to Very Familiar (5)					

Figure 2.1. Emotional Sheet – English Version

2.4 Data Analysis

Descriptive statistical analyses (e.g. boxplots) were conducted to generally assess data patterns. In order to analyse the influence of the wines and of the consumer categorization on the emotional descriptors and on wine evaluation, assumptions for variance analyses were assessed. When the assumptions were not accomplished, the influence of the distinct levels of each factor was evaluated using the non-parametric test of Kruskal-Wallis, based on medians.

In this case, when significant differences were found (α=0.05), the comparison between the distinct levels was made using the ranks instead of mean values. Pearson's correlation coefficient was used to evaluate the relation between global evaluation and emotional descriptors and linear models were established to predict the global evaluation in terms of these descriptors. A Principal Component Analysis was conducted in an attempt to identify some patterns in data and to represent the data in a way that highlights their similarities and differences. Pearson's Chi-squared test was used to comparatively analyse the distributions within each category in the three groups "primary", "perceptive" and "universals". All statistical analyses were conducted with software R (www.r-project.org).

3. Results

3.1 Taster Characterization

The total number of tasters was 143, being 70 females and 73 males, with an average of 35 years old (± 14.5 years) being divided in two classes: A, under 35 (81 tasters) and B, including and over 36 (62 tasters). Regarding food habits and allergies**,** the majority was not vegetarian (137 tasters) and 6 were vegetarians, while 116 did not report food allergies. Smokers were 44, while non-smokers were 99. Regarding wine consumption habits, 33 answered “Never”, 86 replied “1 to 3 Times a week” and 24 were daily drinkers. Self-reported wine knowledge enabled to split the panel in “Beginners”, “Interested” and “Experts”. However, as there were only 3 “Experts”, they were considered together with the “Interested”. Thus, 72 replied as “Beginners”, whilst 71 were “Interested”.

The tasters were also divided in trained and non-trained. The students of the master of Viticulture and Enology of ISA were regarded as trained, while the rest of the consumers were regarded as non-trained. In addition, an exploratory test was run, asking people to guess the colour of the wine served in a dark glass. The wine could be white or red. The answers yield 109 right and 34 wrong responses.

The physiological responses to PROP yielded 44 “Non-Tasters”, 58 “Tasters” and 41 “Super-Tasters”. Wine style preferences were evaluated using the Vinotype online quiz. A total of 35 tasters were “Hypersensitive”, 64 “Sensitive”, 10 “Tolerant” and 34 did not answer (unkown)

Table 3.1 summarizes the number of tasters for each consumer category that revealed later to be statistically relevant.

Table 3.1. Consumer Categorization

Categories		Age		Sex		Food Allergies		Frequency			Knowledge		PROP			Vinotype				Training	
		A	B	F	M	Y	N	Nev	1 to 3	D	Beg	Int	NT	T	ST	Hs	Se	Tol	Unk	NTr	Tr
Age	A	81	---	37	44	17	64	15	57	9	41	40	24	33	24	26	46	6	3	51	30
	B	---	62	33	29	10	52	18	29	15	31	31	20	25	17	9	18	4	31	59	3
Sex	F	37	33	70	---	13	57	20	41	9	39	31	23	30	17	21	28	3	18	50	20
	M	44	29	---	73	14	59	13	45	15	33	40	21	28	24	14	36	7	16	60	13
Food Allergies	Y	17	10	13	14	27	---	4	19	4	12	15	6	12	9	6	16	2	3	21	6
	N	64	52	57	59	---	116	29	67	20	60	56	38	46	32	29	48	8	31	89	27
Frequency	Nev	15	18	20	13	4	29	33	---	---	24	9	10	14	9	13	8	1	11	24	9
	1 to 3	57	29	41	45	19	67	---	86	---	38	48	26	32	28	17	44	6	19	65	21
	D	9	15	9	15	4	20	---	---	24	10	14	8	12	4	5	12	3	4	21	3
Knowledge	Beg	41	31	39	33	12	60	24	38	10	72	---	26	29	17	24	25	5	18	61	11
	Int	40	31	31	40	15	56	9	48	14	---	71	18	29	24	11	39	5	16	49	22
PROP	NT	24	20	23	21	6	38	10	26	8	26	18	44	---	---	13	18	2	11	34	10
	T	33	25	30	28	12	46	14	32	12	29	29	---	58	---	15	29	3	11	43	15
	ST	24	17	17	24	9	32	9	28	4	17	24	---	---	41	7	17	5	12	33	8
Vinotype	Hs	26	9	21	14	6	29	13	17	5	24	11	13	15	7	35	---	---	---	24	11
	Se	46	18	28	36	16	48	8	44	12	25	39	18	29	17	---	64	---	---	45	19
	Tol	6	4	3	7	2	8	1	6	3	5	5	2	3	5	---	---	10	---	7	3
	Unk	3	31	18	16	3	31	11	19	4	18	16	11	11	12	---	---	---	34	34	---
Training	NTr	51	59	50	60	21	89	24	65	21	61	49	34	43	33	24	45	7	34	110	---
	Tr	30	3	20	13	6	27	9	21	3	11	22	10	15	8	11	19	3	---	---	33
Total		81	62	70	73	27	116	33	86	24	72	71	44	58	41	35	64	10	34	110	33

A-under 35; B-35 and over; F-Female; M-Male; Y-Yes; N-No; Nv-Never; 1 to 3-1 to 3 times a week; D-Daily; Beg-Beginner; Int-Interested; NT-Non Taster; T-Taster; ST-Super Taster; Hs-Hypersensitive; Se-Sensitive; Tol-Tolerant; Unk-Unkwon; NTr-Non Trained; Tr-Trained

3.2 Wine Global Evaluation

The mean evaluation scores given by all tasters to the 4 wines using the emotional tasting sheet are presented in table 3.2.

Table 3.2. Mean Wine global evaluation scores using the emotional tasting sheet

Wines*	Colour impression	Initial Odour Impression	Expectation for the Mouthfeel	Mouthfeel impression in Relation to odour	Global Evaluation	Familiarity
1	3.55^{b}**	3.31^{b}	3.19^{b}	3.34^{a}	3.33^{a}	2.66^{b}
2	3.50^{b}	2.77^{c}	2.83^{c}	2.89^{b}	2.89^{b}	2.24^{c}
3	3.34^{b}	2.92^{c}	2.93^{c}	2.66^{b}	2.69^{b}	2.30^{c}
4	4.15^{a}	3.73^{a}	3.55^{a}	3.17^{a}	3.29^{a}	3.09^{a}

* 1, Joseph Cattin Gewurztraminer 2015; 2, Louis Latour Chardonnay Premier Cru 2015; 3, Albert Bichot Vielles Vignes Pinot Noir 2008; 4, Opaco Casa Santos Lima 2015.
** Numbers in the same column followed by different letters are statistically different at $p<0.05$, seriated by ranks.

The highest Colour Impression was from W4, an opaque and intense red that had higher scores than all the other 3 wines, despite being white or red. On the Initial Odour Impression, W4 had also higher scores, followed by W1 and at last W2 and Wine 3. So, intensely flavoured wines had better grades, when compared with the wines consistent with cool climate styles, like W2 and W3. The higher scores for W4 were also observed in the Expectation for the Mouthfeel, followed by W1 and at last W2 and W3. On the Impression in Relation to Odour there was also a clear division. The better grades were given to W1 and W4 and the worst grades are given to W2 and W3. Like the Impression in Relation to Odour, the Global Evaluation also had a clear division between the grades of the wine. The better grades were given to W1 and W4 and the worst grades are given to W2 or W3. Again, on the Familiarity, W4 had significantly better grades, followed by W1 and at last W2 and W3.

As evidenced on the table, W1 and W4 (W4 being more evident) had better grades in all the emotional descriptors. This result corroborates the preference by the consumers for the so-called “easy” wines when compared with the “difficult” ones, consistent with warm and cool climate wine styles, respectively. This difference was even more noticed by the grades given to the Impression in Relation to Odour, the first response elicited

by mouthfeel perception, and the Global Evaluation, where the gap between the "easy" and "difficult" was clear.

Also, there weren't many differences on the global evaluation grades between the wines and the categories, except for the Training and the Vinotype on the Wine 2 (annex 3i.). Therefore, a new segmentation was needed in order to better acknowledge the results. This topic is further explained on 3.7. (Wine Evaluation according to Style Preference).

3.3 Global evaluation prediction

In order to understand which emotional responses influenced more the global evaluation, correlations were established and assessed through the determination of coefficients of determination (R^2). Table 3.3 and 3.4 summarize these correlations.

Table 3.3. Correlations between all the emotional descriptors

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression In Relation to Odour	Global Evaluation	Familiarity
Colour Impression	1.00	0.44	0.40	0.23	0.25	0.19
Initial Odour Impression	0.44	1.00	**0.73**	0.45	0.50	0.38
Expectation for the Mouthfeel	0.40	**0.73**	1.00	0.50	0.52	0.33
Impression in Relation to Odour	0.23	0.48	0.50	1.00	**0.83**	0.42
Global Evaluation	0.25	0.50	0.52	**0.83**	1.00	0.49
Familiarity	0.19	0.38	0.33	0.42	0.49	1.00

Table 3.4. Statistical parameters of the correlation between Global Evaluation and the other tasting parameters.

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Familiarity
R^2	0.06	0.25	0.27	0.69	0.24
p-value	$2.64e^{-9}$	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$

The highest correlation was obtained with the mouthfeel Impression in Relation to Odour, which suggests that this emotional descriptor elicited by mouth had the highest influence on the global evaluation score. Afterwards, the correlations with the Expectation for the Mouthfeel, Initial Odour Impression and Familiarity had approximately the same R^2, meaning that they had a similar share in the Global Evaluation prediction. Lastly, the Colour Impression had a coefficient of determination of only 0.06, indicating the relative absence of influence on the Global Evaluation.

Global Evaluation may also be related with more than one independent variables (Table 3.5). The approaches to adapt a linear model with more variables showed that the coefficient of determination (R^2) increased, the highest being 0.72 corresponding to the cumulative influence of the independent variables: Impression in Relation to Odour, Familiarity and Expectation for the Mouthfeel. However, this value was only slightly higher than the 0.69 coefficient obtained for the Impression in Relation to Odour. Therefore, Global Evaluation is mainly driven by an in-mouth perception.

Table 3.5. Statistical parameters obtained for linear adjustments between Global Evaluation and more than one tasting parameters.

	Colour Impression + Impression in Relation to Odour	Expectation for the Mouthfeel + Impression in Relation to Odour	Initial Odour Impression + Impression In Relation to Odour	Impression In Relation to Odour + Familiarity	Colour Impression + Impression In Relation to Odour + Familiarity	Expectation for the Mouthfeel + Impression In Relation to Odour + Familiarity
R^2	0.69	0.70	0.71	0.71	0.71	0.72
p-value	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$	$<2.2e^{-16}$

With the three parameters “Expectation for the Mouthfeel”, “Impression in Relation to Odour” and “Familiarity”, a model was adjusted having the highest determination coefficient ($R^2 = 0.72$), meaning that 72% of the total variability of the Global Evaluation may be explained by the equation:

Global Evaluation = 0.16 + 0.12 * Expectation for the Mouthfeel + 0.72 * Impression in Relation to Odour – 0.13 * Familiarity

The correlations between all the emotional descriptors are listed in table 3.5. The highest correlation was between the Global Evaluation and the Impression In Relation to Odour (0.83) and between the Initial Odour Impression and Expectation for the

Mouthfeel (0.73). These correlations corroborate the results of the global evaluation predictions and the Expectation after the Initial Impression.

3.4 Principal Component Analysis (PCA)

The different emotional responses and familiarity elicited by the 4 wines may be highlighted through a PCA. The first two components of the PCA accounted for 71% of the data variance (Table 3.6), meaning that most of the differences between the wines may be explained by the variables listed in Table 3.7.. The first PC was composed by positive values of all variables, placed in the right side of the x-axis (Figure 3.1). Therefore, all variables have the same tendency and, except for the colour impression, all of them have similar weight, equally contributing to the variability of the PC1. The second PC opposed Colour Impression, Initial Odour Impression and Expectation for the Mouthfeel to impression in Relation to Odour, Global Evaluation and Familiarity.

Table 3.6. Proportion of explained variance by each PCA.

	PC1	PC2	PC3	PC4	PC5	PC6
Proportion of Variance	0.55	0.16	0.13	0.09	0.04	0.03
Cumulative Proportion	0.55	0.71	0.84	0.93	0.97	1.00
Standard Deviation	2.05	1.1238	0.99	0.83	0.57	0.46

Table 3.7. Coordinates of each variable for PCA1 and PCA 2.

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation	Familiarity
PC1	0.2460	0.4251	0.4181	0.4419	0.4700	0.4097
PC2	-0.5360	-0.3981	-0.3781	0.2692	0.2780	0.5114

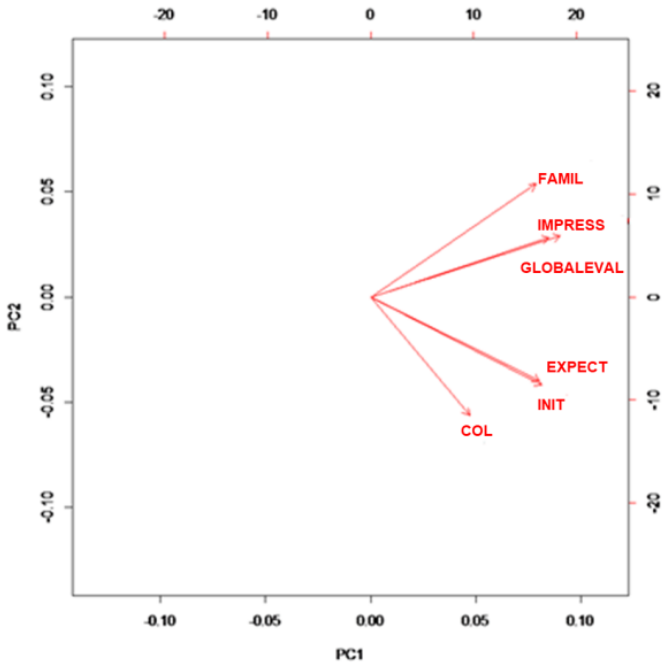

Figure 3.1. First factorial correlation plot of the PCA based on emotional and familiarity responses.

On PC1, all the vectors are positive, that means that they all have the same tendency. The smaller the angle, that they form, the greater the relation between the emotional descriptors, and also contribute more to the PC (if it is related to PC1, the more horizontal the vector, the more it contributes to its explanation). As it was seen before in table 3.5, figure 3.1 points out clearly the strong correlation between global evaluation and Impression in Relation to Odour, and between Initial Odour Impression and Expectation for the Mouthfeel and the weak correlation between Familiarity and Colour Impression.

Also, the proximity between the variables means that the smaller the length, the less the relevance of the variable. All the emotional descriptors have the same length, in exception to the Colour Impression, meaning that they all contribute equally for the PC1 variability. Moreover PC2 reflects the good adjustments between Global Evaluation, Impression in Relation to Odour and Familiarity and also Initial Odour Impression, Expectation for the Mouthfeel and Colour Impression.

3.5 Influence of Consumer Categorization on the Emotional Descriptors

The evaluation scores given by the tasters to the emotional descriptors and familiarity according to each category and considering the four wines are listed in Table 3.8.

Table 3.8. Mean consumer scores Categorization on the Emotional Descriptors

Category	Class	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation	Familiarity
Age	<35	3.72[a*]	3.33[a]	3.31[a]	3.25[a]	3.25[a]	2.68[a]
	>=35	3.52[b]	3.00[b]	2.89[b]	2.71[b]	2.79[b]	2.44[b]
Sex	F	3.61[a]	3.17[a]	3.05[a]	2.98[a]	3.02[a]	2.50[a]
	M	3.66[a]	3.20[a]	3.20[a]	3.05[a]	3.08[a]	2.64[a]
Food Allergies	Y	3.81[a]	3.39[a]	3.29[a]	3.00[a]	3.08[a]	2.56[a]
	N	3.60[b]	3.14[b]	3.08[a]	3.02[a]	3.04[a]	2.64[a]
Frequency	Nv	3.74[a]	3.11[a]	3.02[a]	2.83[b]	2.88[a]	2.35[b]
	1 to 3	3.62[a]	3.23[a]	3.12[a]	3.09[a]	3.13[a]	2.64[a]
	D	3.54[a]	3.14[a]	3.27[a]	3.02[ab]	3.00[a]	2.67[a]
Training	NTr	3.57[b]	3.01[b]	3.06[b]	2.98[a]	3.02[a]	2.53[a]
	Tr	3.84[a]	3.47[a]	3.34[a]	3.13[a]	3.16[a]	2.72[a]
Knowledge	Beg	3.63[a]	3.13[a]	3.06[a]	2.97[a]	3.00[a]	2.28[b]
	Int	3.63[a]	3.24[a]	3.19[a]	3.06[a]	3.10[a]	2.87[a]
PROP	NT	3.60[a]	3.00[b]	3.04[a]	2.91[a]	3.00[a]	2.27[b]
	T	3.65[a]	3.29[a]	3.21[a]	3.10[a]	3.10[a]	2.69[a]
	ST	3.66[a]	3.23[a]	3.09[a]	3.00[a]	3.03[a]	2.73[a]
Vinotype	Hs	3.72[a]	3.20[a]	3.12[a]	3.11[a]	3.13[a]	2.51[a]
	Se	3.74[a]	3.34[a]	3.32[a]	3.12[a]	3.18[a]	2.63[a]
	Tol	3.89[a]	3.25[a]	3.18[a]	2.95[ab]	2.93[ab]	2.63[a]
	Unk	3.27[b]	2.85[b]	2.74[b]	2.74[b]	2.76[b]	2.51[a]

F-Female; M-Male; Y-Yes; N-No; Nev-Never; 1 to 3-1 to 3 times a week; D-Daily; Beg-Beginner; Int-Interested; NT-Non-Taster; T-Taster; ST-Super-Taster; Hs-Hypersensitive; Se-Sensitive; Tol-Tolerant; Unk-Unknown; NTr-Non-Trained; Tr-Trained

* Numbers in the same line column followed by different letters are statistically different at $p<0.05$, seriated by ranks.

In all the emotional descriptors, the younger tasters gave better grades than the older ones. Sex, food habits and smoking did not influence significantly, all the emotional descriptors. People who reported to have food allergies, gave better scores to the Colour Impression and to the Initial Odour Impression. That is, the most immediate emotional descriptors. For all the other emotional descriptors, similar scores were given.

Regarding the emotional descriptor, Impression In Relation to Odour, people who drink wine 1 to 3 times a week gave better grades, consumers who never drink wine gave worst scores, and people who drink daily gave intermediate grades. Also, people who never drink wine, gave worst grades related to the Familiarity. All the other emotional descriptors are not influenced by the consuming frequency.

Relatively to the training, the trained tasting panel gave better grades only to the emotional descriptors of Colour Impression, Initial Odour Impression and Expectation for the Mouthfeel, that is, the most immediate emotional descriptors. About the knowledge of wine, the level of knowledge did not influence emotional descriptors, except for the Familiarity. As expected, the Beginners gave worst grades than the Interested.

Considering the PROP segmentation, it only raised significant effect in the Initial Odour Impression and in the Familiarity. In these emotional descriptors, the Non-Taster gave worst grades, whereas the Tasters and Super-Taster gave the same grades. Lastly, in the vinotype segmentation, the people who did not answer the online test, gave worst grades to all the emotional descriptors in exception for the Familiarity, while all the other vinotype groups gave the same grades.

3.6 Influence of Familiarity on Wine Evaluation

The evaluation grades given by the tasters to the emotional descriptors as a function of Familiarity are listed in the Table 3.9. There was a clear tendency in all the emotional descriptors, tasters who gave in them better grades, also gave good grades regarded to familiarity of the wine. The opposite was also true. Worst grades were also related to bad grades on Familiarity. These results point out that knowing the wines is a major part of liking the wines, and consequently, giving them better grades.

Table 3.9. .Mean Emotional responses according to Familiarity scores.

Familiarity scores	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation
1	3.53^{cd*}	2.71^{d}	2.68^{d}	2.44^{e}	2.35^{d}
2	3.37^{d}	3.01^{c}	2.96^{c}	2.76^{d}	2.76^{c}
3	3.65^{bc}	3.21^{c}	3.29^{b}	3.19^{c}	3.34^{b}
4	3.80^{b}	3.60^{b}	3.37^{b}	3.53^{b}	3.58^{b}
5	4.42^{a}	4.36^{a}	4.17	3.97^{a}	4.19^{a}

* Numbers in the same line column followed by different letters are statistically different at p<0.05, seriated by ranks.

Also, when comparing Familiarity and the segmentations such as the age, sex and wines, there's always a tendency to give better grades when the Familiarity has also good grades in all the emotional descriptors (Annex 3a., 3b., 3c.). This also corroborates the influence of familiarity on the wine evaluation.

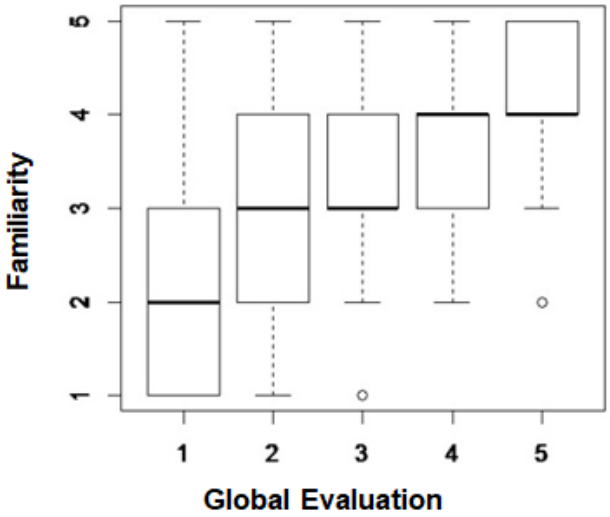

Figure 3.2. Global Evaluation vs Familiarity Boxplot.

This boxplot (figure 3.2) evidences the relation between Global Evaluation and Familiarity. The median of Global Evaluation is always rising as the grades from the familiarity also rise. This was verified from the lowest grade to the highest grade. The majority of the tasters on the lowest grades on the Global Evaluation, give lower grades to the Familiarity, and the opposite also occur.

The majority of the tasters on the highest grades on the Global Evaluation, give better grades to the Familiarity. For example, from the tasters who gave "5" on the familiarity: only one taster gave a "2" grade on the global evaluation, and the majority gave 4 or better.

3.7 Wine Evaluation according to Style Preference

The large range of scores given to the different wines provided mostly non-significant differences among the several *a priori* consumer categories. Therefore, another approach based on wine style preference after tasting was tried to find any possible

way of consumer grouping. Knowing that wines were selected as representatives of cool and warm climate styles, consumers were separated according those providing higher scores (4 or 5) to each of the styles. The groups were named according to the type of emotional responses, as described below.

3.7.1 Primary consumers

This group gathered the tasters that gave grades in the overall evaluation of 4 or 5 to the warm climate wine styles (Wine 1 and Wine 4). Table 3.10 summarizes their responses in the emotional sheet.

Table 3.10. Mean Wine Evaluation of the "Primary" tasters.

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation	Familiarity
Wine 1	3.72^{b*}	3.77^{b}	3.62^{b}	4.23^{a}	4.41^{a}	3.00^{b}
Wine 2	3.18^{c}	2.41^{d}	2.56^{c}	2.64^{b}	2.74^{b}	2.15^{c}
Wine 3	3.72^{b}	3.15^{c}	3.21^{b}	2.92^{b}	3.05^{b}	2.49^{bc}
Wine 4	4.36^{a}	4.31^{a}	4.10^{a}	4.05^{a}	4.28^{a}	3.64^{a}

* Numbers in the same line column followed by different letters are statistically different at $p<0.05$, seriated by ranks

As shown on the table 3.10, there was a clear gap tendency in all the emotional descriptors between the easy and difficult wines. As expected, Wine 1 and Wine 4 had significantly better grades. In colour impression, Wine 4 had almost a perfect score, followed by Wine 1 and Wine 3 and at last Wine 2. In the Initial Odour Impression and Expectation for the Mouthfeel, Wine 4 had better scores, followed by Wine 1. The Impression in Relation to Odour and the global evaluation have the most distinct differences between the easy wines and difficult wines. In both the emotional descriptors, Wine 4 and Wine 1 had significantly higher better grades. The gap between the grades in the Familiarity are not so evident, however, Wine 4 had again better scores, followed by the Wine 1 and at last Wine 2 and Wine 3. This segmentation expressed the characteristics of Primary likers and the differences between the grades given of the wines. In all the emotional descriptors, Wine 4 (mainly) and Wine 1 had consistently better grades than Wine 2 and Wine 3.

In a total of 143 tasters, this segmentation contained a total of 38 tasters, 26.6% of the tasting panel. The Primary name for this group is understandable because individuals consistently responded with positive emotions to the wines they were familiar with.

3.7.2 Perceptive consumers

This segmentation was done by the tasters who gave grades in the overall evaluation of 4 or 5 to the cool climate wine styles (Wine 2 and Wine 3). Table 3.11 summarizes their results on the emotional sheet.

Table 3.11. Mean Wine Evaluation of the "Perceptive" tasters.

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation	Familiarity
Wine 1	3.75^{a*}	3.50^{a}	3.00^{b}	3.00^{b}	3.06^{b}	2.94^{a}
Wine 2	3.88^{a}	3.13^{a}	3.31^{ab}	4.00^{a}	4.06^{a}	2.69^{a}
Wine 3	4.00^{a}	3.88^{a}	3.81^{a}	4.00^{a}	4.19^{a}	3.06^{a}
Wine 4	3.88^{a}	3.50^{a}	3.06^{ab}	3.00^{b}	3.13^{b}	3.25^{a}

* Numbers in the same line column followed by different letters are statistically different at $p<0.05$, seriated by ranks.

As shown on the table 3.11, there was not a clear gap tendency in all the emotional descriptors, between the easy and difficult wines. As expected, Wine 2 and Wine 3 had better grades on the Global evaluation, also on the mouth Impression in Relation to Odour, but in the other emotional descriptors there was not a difference between the wines. The Colour Impression and the Initial Odour Impression were the same for all wines. Regarding the Expectation for the Mouthfeel, the Wine 3 had better grades, while the Wine 1 had the worst. The Impression in Relation to Odour and the Global Evaluation showed the significantly different grades between the Wines 2 and 3 and the Wines 1 and 4. The grades of the Global Evaluation reflected the grades of the Impression in Relation to Odour, which had the highest correlation between the Global Evaluation. Lastly, the Familiarity also did not seem to influence differently the grades among the perceptive likers.

The grades given by the perceptive tasters showed some wine knowledge. Their behaviour indicates that they were positively influenced by the taste when comparing

with the colour or smell. In addition, all wines were equally familiar to them. Only 16 out of 143 tasters, 11.2% of the tasting panel were inserted in this category

3.7.3 Universal consumers

This segmentation was done by the rest of the tasters. Meaning, the ones who did not give 4 and 5 on the easy or difficult wines.

Table 3.12. Mean Wine Evaluation of the "Universal" tasters.

	Colour Impression	Initial Odour Impression	Expectation for the Mouthfeel	Impression in Relation to Odour	Global Evaluation	Familiarity
Wine 1	3.48^{b*}	3.11^{b}	3.06^{b}	3.06^{a}	2.96^{a}	2.50^{ab}
Wine 2	3.57^{b}	2.87^{bc}	2.85^{bc}	2.82^{a}	2.75^{a}	2.22^{bc}
Wine 3	3.06^{c}	2.67^{c}	2.71^{c}	2.34^{b}	2.31^{b}	2.10^{c}
Wine 4	4.010^{a}	3.53^{a}	3.38^{a}	2.82^{a}	2.92^{a}	2.82^{a}

* Numbers in the same line column followed by different letters are statistically different at $p<0.05$, seriated by ranks.

As shown on the table 3.12, Wine 4 had better grades in all the emotional descriptors, while Wine 3 had the worst grades in all the emotional descriptors. Wine 1 and Wine 2 had similar grades, even though Wine 1 had a better mean in all the emotional descriptors in exception of the Colour Impression.

The universal likers had the same pattern on the Colour Impression, Initial Odour Impression and Familiarity. As it was said before, they showed a clear preference for the Wine 4 and a dislike for the Wine 3. The grades of the Global Evaluation reflect the grades of the Impression in Relation to Odour, which had the highest correlation between the Global Evaluation. These grades highlight the dislike for the Wine 3.

These grades given by the universal likers show a different behaviour on the emotional tasting, comparing to the other consumers. Wine 4 isolates among all of them, followed by the Wine 1 and Wine 2, and lastly the Wine 3. So, there were not two clear groups as was on the primary and perceptive consumers.

The fact that they only give significantly better scores on the Impression in Relation do Odour (besides the Global Evaluation) show that emotional descriptor is the most

important of them all, and corroborates the correlation to the global evaluation. The Colour Impression, the Initial Impression and the Familiarity do not influence the grades at all, and that is a correct way of tasting wine and not be influenced by predefined factors. In a total 143 tasters, 89 were inserted on this category, making a 62.2% of the tasting panel. So, the majority of the tasting panel are on these consumers group.

The consumer categorisation based on wine style preference yielded groups with different numbers of consumers and it would be interesting to check if there is any *a priori* category that could be prevalent in each of them. A Pearson's qui-squared test was performed to check if the category composition of each consumer group was different from those of all individuals. The results in Table 3.13 show that only in the Age category there was a higher proportion of tasters with less than 35 years in the Perceptive group.

Table 3.13. Composition of consumer categories according to wine style preference groups.

Category	Class	Number	Percentage			
			Overall (n=143)	Primary (n=38)	Perceptive (n=16)	Universal (n=89)
Age	<35	81	56.6	66.6	**81.3**	48.3
	>=35	62	43.4	33.3	**18.7**	51.7
Sex	Female	70	49.0	51.3	43.7	48.3
	Male	73	51.0	48.7	56.3	51.7
Frequency	Never	33	23.1	23.1	12.5	19.1
	1-3 Times	86	60.1	64.1	68.7	56.2
	Daily	24	16.8	12.8	18.8	24.7
Knowledge	Beginners	72	50.3	41.0	43.8	52.8
	Interested	71	49.7	59.0	56.2	47.2
PROP	Non-Taster	44	30.8	30.8	43.8	31.5
	Taster	58	40.6	51.3	37.4	39.3
	Super-Taster	41	28.6	17.9	18.8	29.2
Vinotype	Hypersensitive	35	24.4	25.6	31.3	23.6
	Sensitive	64	44.8	51.3	56.3	38.2
	Tolerant	10	7.0	5.1	6.3	20.5
	Unknown	34	23.8	18.0	6.3	17.7
Training	Untrained	110	77.0	71.8	62.5	79.8
	Trained	33	23.0	28.2	37.5	20.2

Interestingly, the knowledge and training categories that would be expected to influence the preference for cool climate wines were similar in all groups. One can

argue that the self-reported knowledge and training are not accurate measures of such features but it is also possible to speculate that in the tasting panel the “connoisseurs” preferred warm climate wine styles because they were familiar with and not open to recognise the quality of other wines. On the contrary, younger individuals displayed a higher familiarity to all wines, recognising the quality of wines that elicited emotional responses of unpleasantness from most consumers.

4. Discussion

The relevance of using emotional responses to characterise consumer preferences is increasing in food science (Lagast et al., 2017). Understanding the relationship between sensory attributes and emotional responses may prove even more insightful than the traditional focus on sensory attributes and liking (Ng et al., 2013). In wine, Parr (2018) clearly stated the consensual model dominant in wine sensory analysis is limited, at best, and inappropriate for sensory analysis of complex products such as wine in many contexts. This author further argues that differences amongst tasters, reflecting each individual's physiology, experience and knowledge, are valid data in themselves rather than “error in the machine” as they were conceptualised within traditional consensus models of sensory analysis. The emotional wine tasting approach presented by Brasil et al. (2016) and further developed by Coste et al. (2018), support the argument of Parr (2018). In particular, Coste et al. (2018) explored the cognitive dissonance between high expectations induced by flavour followed by in-mouth deceptions to explain the difference between wines of the international style with cool climate wine styles. The most significant attributes were of emotional nature and tasters had references of both styles to compare the wines under examination. This work was a continuation of Coste et al. (2018), now using only questions of emotional nature and a familiarity inquiry, without previous training or wine prototypes to compare with. The wines were selected to showcase the two different broad international and cool climate styles either in whites or in reds. Overall, this study demonstrated that emotional responses enable to understand the consumer preferences for these two main wine styles and provide further support to the use of emotional responses to understand wine preferences.

The differences in consumer behaviour enabled to distinguish 3 groups of consumers. One group, called Primary, gave consistently higher scores to the international style justifying their epitome because were attracted by the intense fruity and smooth mouthfeel character that are sensorially more pleasant. Besides the sensory driven aspect of liking, their preferences were limited to the familiar wines. The second group was coined as “Perceptive” because despite rating the odour induced responses equally for both wine styles, did penalise the international style with lower in-mouth scores. Probably, international style wines did not impress these individuals where the initial attractiveness of the flavours was accompanied by a deception after tasting. This behaviour was particularly noted with the Gewurztraminer wine which exuberant smell elicited the lowest expectations for the mouthfeel that were confirmed by the lowest in-mouth derived scores. The familiarity scores were similar among all wines indicating a

previous exposure to a wider range of styles. Finally, the largest group was named “Universal” because encompassed a wide range of responses. However, their overall preferences were more close to the “Primary” counterparts than to the “Perceptive” ones.

The results reported in this work reflect the global drivers of consumer preferences where fruit or floral driven wines with smooth mouth-feel are usually preferred against earthy, musty, vegetal, sour and astringent wines (Francis and Williamson, 2015). The 3 groups of consumers find also correspondence with the segmentation by quality dimension perception proposed by Charters and Pettigrew (2006) according to the consumer involvement level. Low involvement individuals are comparable to the “Primary” group, where taste pleasure and smoothness were primarily significant. The more-highly involved looked for more cognitive dimensions like interest, distinctiveness and complexity that is consistent with the preferences shown by the “Perceptive” group. These authors also propose a medium-involvement level sharing the dimensions of taste and appearance with the low-involvement consumers but focusing also on the dimensions of complexity and interest, comparable to the “Universal” group. Coincidently, high-involved and “Perceptive” consumers were the minority in both studies.

Concerning study limitations, one main issue is the nationality bias, being most consumers Portuguese it is obvious that preferred wines are those more familiar to. It would be interesting to extend this work to persons more familiar to cool climate wines and check if their responses would yield similar results. However, when comparing with literature, Portuguese respondents share their main preferences for fruity, sweet and smooth wines with other international consumers (Hopfer and Heymann, 2014; Francis and Williamson, 2015). In addition, wine styles were limited to only 4 examples being interesting to use other wines (e.g. with oak flavours, with aging character) representing variations within the international palate and the cool climate wine styles.

5. Conclusions and Future Perspectives

This work demonstrated that emotional responses can be used to understand consumer preferences for wines with different styles. Overall, higher mean scores were given to wines with intense flavour and smooth mouthfeel in opposition to wines with less flavour and more sour or astringent mouthfeel. This behaviour corresponds to the expected higher liking for international commercial wines characteristic of warm regions, referred as “easy” wines in opposition to the “difficult” ones by Coste et al. (2018). The mouthfeel response had the highest influence on global evaluation, followed by the odour and familiarity responses. Colour did not seem to influence wine appreciation so strongly. It was interesting to observe that familiarity was linked to high global evaluation, meaning that consumers rated better what they are aware of. It was possible to divide the consumers in 3 groups. The first (Primary), preferring the international style and unfamiliar to the cool climate wine styles. A second (Perceptive) group, preferring the cool climate wine styles but being familiar with all wines. A third group (Universals) included those with variable responses to all wines.

In further works, some individual physiological/emotional preferences could be developed in order to better evaluate consumer segmentation, being wine familiarity a key factor on this future analysis. Additionally it would be interesting to understand how people change their preferences and if is it easy to introduce new wine styles.

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Annexes

1. Tasting Sheets

1a. Demographic information/Saliva test

Date___/__/_____

Name _____

Age_____ Gender (F/M) ____ Country _____

Study Background _____

Smoker (Y/N/Sometimes) _____ Vegetarian (Y/N) _____ Food Allergy (Y/N) _____

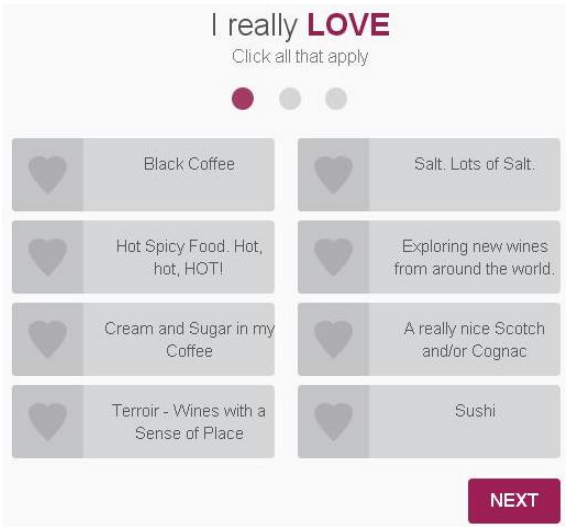
Vinotype _____

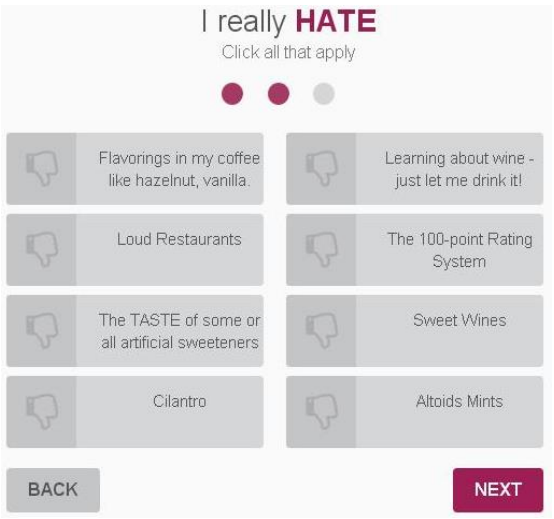
Wine Expertise

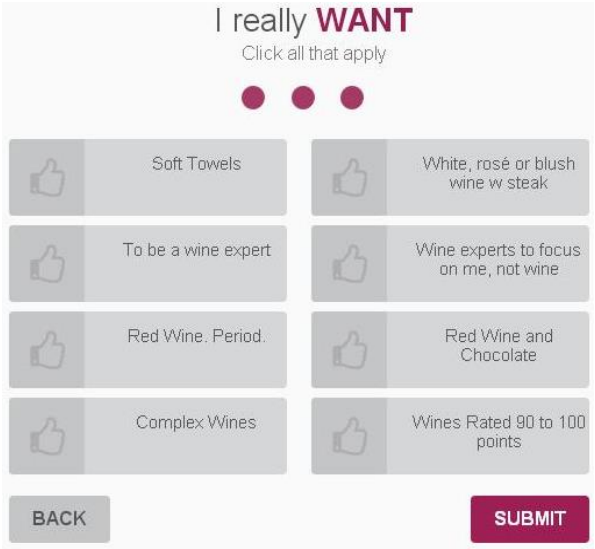
I don't drink wine	☐
Beginner	☐
Intermediate	☐
Very high	☐

1b. Vinotype

Website: www.myvinotype.com







1c. Evaluation of Sensations

Date___/__/_____

Name

_____

Imagine having the following five sensations:

1) Sourness of a lemon;

2) Pain from biting your tongue;

3) Coolness of an ice-cold beverage;

4) Burning sensation from eating a whole hot pepper;

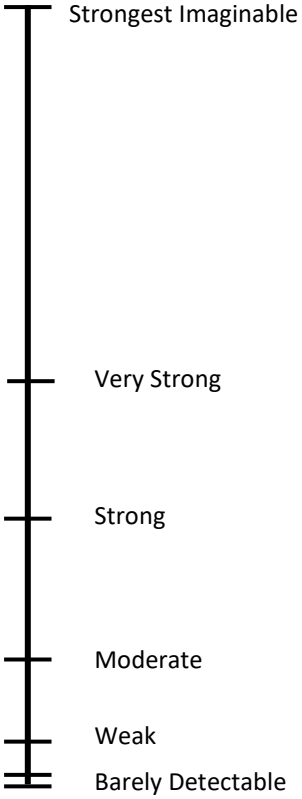
5) Brightness of the sun when you are looking directly at it.

Please rate the intensity of the five remembered sensations by drawing a horizontal line across each scale.

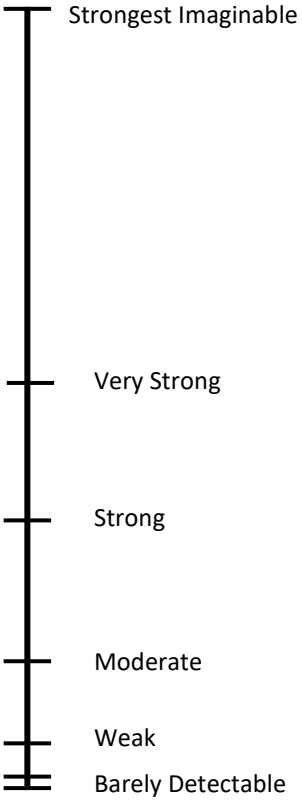
Write down the most intense sensation in any modality that you could ever imagine experiencing.

---

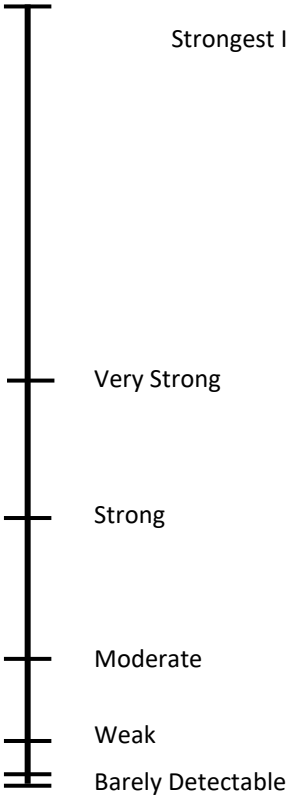
1) Sourness of a lemon



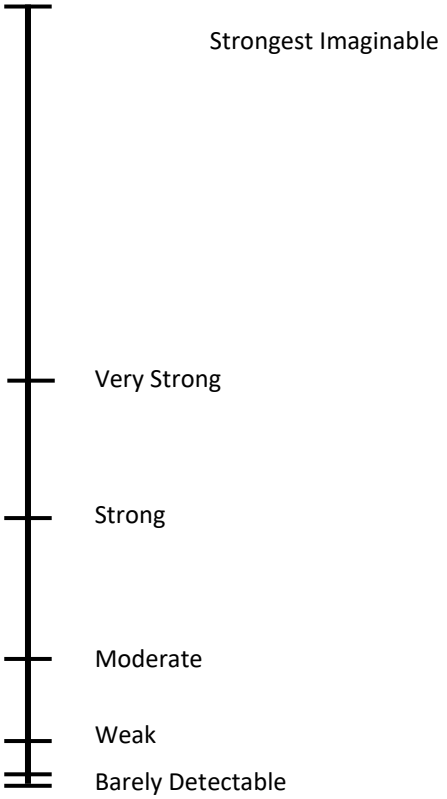
2) Pain from biting your tongue



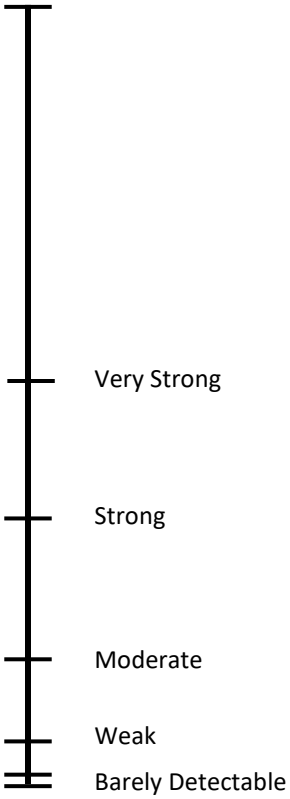
3) Coolness of an ice-cold beverage



4) Burning sensation from eating a whole hot pepper



5) Brightness of the sun when you are looking directly at it



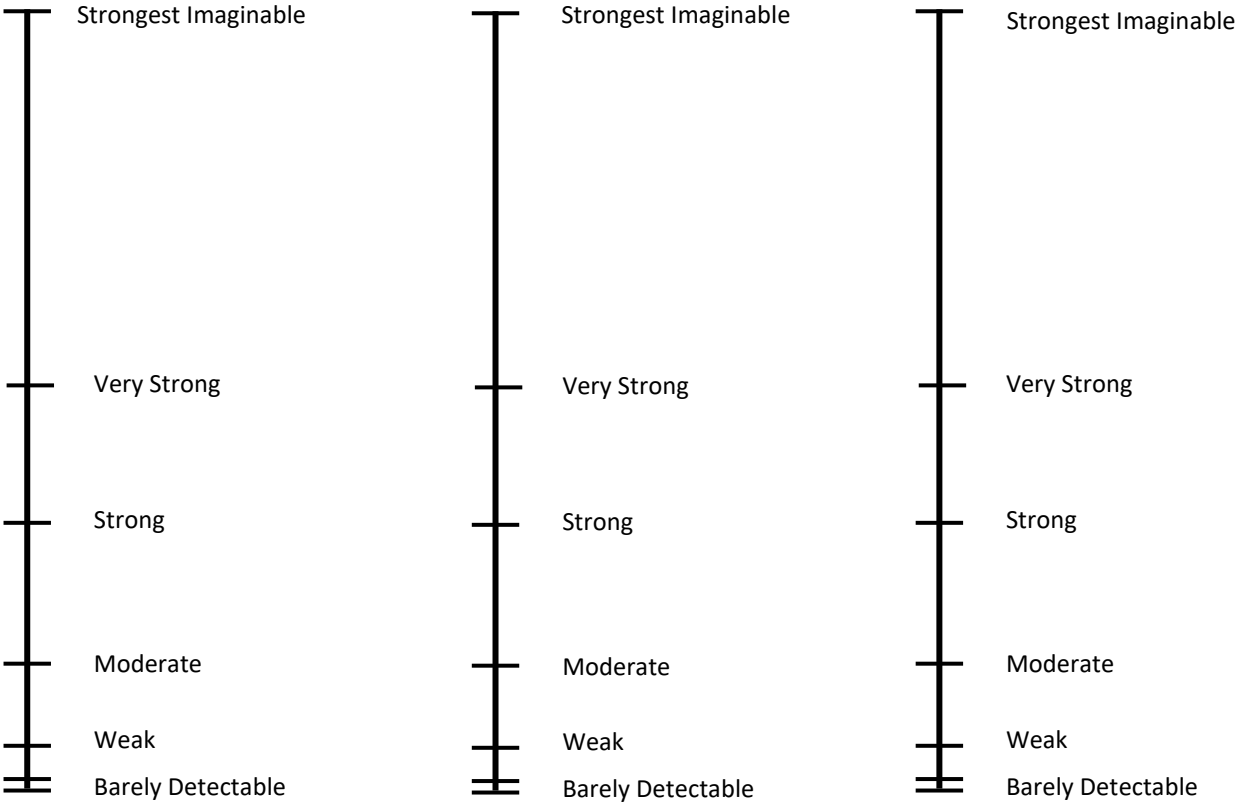
1d. PROP Status, Sodium Cloride, Tartaric Acid, Tannic Acid and Sucrose Intensity (Water)

Date___/__/_____

Name

_____

Rinse with water before beginning. Put the sample in the mouth, rinse for 10 seconds, being sure that you cover all the mouth surfaces and wait for the sensation intensity to peak (10-15 s). The maximum intensity is 10 seconds after spiting. After you taste the first sample rate the intensity of the sensation by drawing a mark on the LMS Scale. Rinse with spring water and wait 1 minute between samples. Repeat the same procedure with the other 2 samples.



432	176	891

1e. Emotional Tasting Sheet

Nome: _____ Idade:_____ Sexo: F ☐ M ☐

E-mail: _____

Vegetariano: Sim ☐ Não ☐ Alergias:_____ Fumador:_____

Frequência semanal: Nunca ☐ 1 a 3 Vezes ☐ Diariamente ☐

Considero-me: Perito ☐ Interessado ☐ Novato ☐

1. Teste do Copo Preto

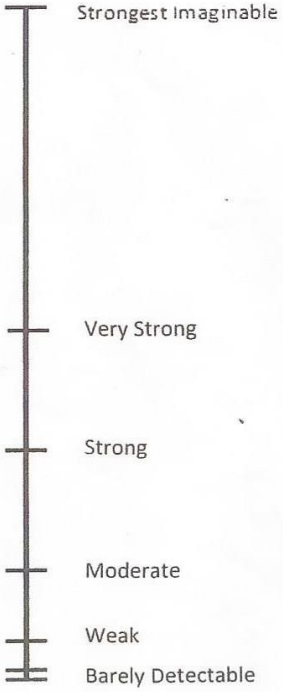
O vinho que tem no copo preto é: branco ☐ tinto ☐

2. Teste de sensibilidade ao PROP

O copo transparente tem solução aquosa de PROP a 0,32 mM.

Na escala lateral, marque horizontalmente a intensidade da sensação amarga que detecta ao provar.

Espere alguns segundos até atingir sensação máxima.



3. MyVinotype

Acesse a um dos computadores / tablets disponíveis. Na página www.myvinotype.com responda às perguntas para descobrir o seu Vinotype.

O resultado foi: _____

Respostas Emocionais ao Consumo de Vinho

Ficha de Prova Emocional		Vinho 1	Vinho 2	Vinho 3	Vinho 4
Avaliação Visual					
Cor	Desagrado (1) a Gosto Muito (5)				
Avaliação Olfactiva					
Impressão Inicial	Desagrado (1) a Gosto Muito (5)				
Expectativa para a boca	Baixa (1) a Alta (5)				
Avaliação Gustativa					
Impressão em relação ao odor	Decepcionante (1) a Surpreendentemente Bom (5)				
Avaliação Global					
Não gosto nada (1), Não gosto (2), Indiferente (3), Gosto (4), Gosto muito (5)					
Grau de familiaridade com o tipo de vinho					
Nunca tinha provado (1), Lembra-me algo (2), Não me é estranho (3), É-me familiar (4), É-me muito Familiar (5)					

2 Wine Data Sheet

2a. Gewurztraminer Alsace Joseph Cattin

GEWURZTRAMINER

JOSEPH CATTIN

Very aromatic, Joseph Cattin Gewurztraminer can be enjoyed as an aperitif as well as with exotic dishes, strong cheeses and desserts.

Appellation	AOC Alsace
Grape Variety	Gewurztraminer
Soil	Mostly clay and limestone
Ageing Potential	Drink now or within the next 5 years

Viticulture

Limited yields. Guyot pruning, with 5 500 vines per ha on average. Sustainable farming practices to preserve the richness of our terroirs.

Wine-making

Gentle pressing of the grapes. Fermentation between 18 and 22℃.

Tasting Notes

Appearance: clear, pale gold.
Nose: perfumed nose with litchi and mango aromas; a delicate touch of rose water.
Palate: ripe exotic fruits with rose flavors; well-balanced between spiciness and freshness; a long-lasting finish.

Serving

This Gewurztraminer can be served on its own as an aperitif. It will pair well with foie gras and spicy cuisines based on curry, ginger or chili. It can also be enjoyed with strong cheese like munster and maroilles.

Serving Temperature: 8-10℃.

2b. Chardonnay Premier Cru Bourgogne Louis Latour

Louis Latour

MAISON FONDÉE EN 1797

BOURGOGNE CHARDONNAY
2015

- **RÉGION** Bourgogne
- **VILLAGE** Bourgogne
- **APPELLATION** Bourgogne
- **CÉPAGE** Chardonnay

La vigne

- **AGE MOYEN** 30 ans
- **SOUS-SOL** Argile et glaise
- **RENDEMENT MOYEN** 45 hl/ha
- **VENDANGE** Manuelle

Vinification & Elevage

- **FERMENTATION** Traditionnelle en cuve Inox, température contrôlée, malolactique à 100%
- **ELEVAGE** 8 à 10 mois en cuve inox

Description

Fruits d'une longue histoire, la Bourgogne et ses vins sont réputés dans le monde entier. Le Chardonnay en est un cépage indigène, c'est à dire originaire de cette région. Les terrains de prédilection du Chardonnay correspondent parfaitement aux terroirs de Bourgogne: des sols peu fertiles calcaires ou marneux, de belles expositions mais un climat tempéré. La teneur en sucre peut ainsi atteindre un niveau élevé tout en conservant un bon équilibre fruit-acidité.

Dégustation

- **NOTE DE DÉGUSTATION** Le Bourgogne blanc 2015 s'ouvre avec un nez floral et frais de chèvrefeuille. La bouche est ronde et gourmande avec de jolies notes d'amandes fraîches
- **POTENTIEL DE GARDE** 2-5 ans
- **ACCORD METS/VINS** Apéritif - crustacés - charcuterie fine - poisson grillé
- **TEMPÉRATURE DE SERVICE** 10-12°

2c. Albert Bichot Bourgogne Vielles Vignes de Pinot Noir

DOMAINES
ALBERT BICHOT
MAISON FONDÉE EN 1831

BOURGOGNE "VIEILLES VIGNES" DE PINOT NOIR

Bourgogne	100 % Pinot Noir	AOC Régionale
The vineyard:	**Vinification:**	**Ageing:**
Calcareous clay soil	Temperature-controlled conical oak vats Temperature-controlled stainless steel tanks 18 to 25 days	20 to 30% oak barrels 70 to 80% in vats 8 to 12 months

Our Bourgogne Pinot Noir "Vieilles Vignes" (old vines) is crafted from grapes grown on vines that are between 25 and 30 years old and are located in the Côte de Beaune and Côte de Nuits. The varying exposure and altitude of these vineyards allow us to create this mosaic of parcels, resulting in this wine's beautiful complexity. The venerable age of the vines gives the wine its remarkably concentration, with straightforward, characteristic flavours that are recurrently honoured at prestigious contests.

Tasting notes

Flattering nose with an appealing palette of fruity aromas (blackcurrant, redcurrant, plum). Fleshy and balanced on the palate with oaked notes and a pleasing finish.

Food/wine pairing

This wine is a fine match for roasted or grilled meats, poultry, vegetables and mild cheeses.

Serving and cellaring

Serve at 14 -15°C. (57-59°F)
This wine is best enjoyed within 3 to 5 years of purchasing to fully appreciate its fruitiness.

2d. Opaco Casa Santos Lima

Opaco

DENOMINAÇÃO
Vinho Regional Lisboa, Tinto

CASTAS
Sousão, Alicante Bouschet

VITICULTURA
Densidade de 4.200 Plantas/ha. Solos argilo –calcários

VINDÍMA
Fim de Agosto até meados de Outubro.

VINIFICAÇÃO
Desengace total seguido de maceração pré-fermentativa a baixas temperaturas. Fermentação alcoólica durante 15 dias em depósitos de aço-inox com sistemas de controlo de temperatura, não ultrapassando os 26.º C.
Fermentação maloláctica e estágio tiveram lugar em 50% de barricas novas de carvalho americano e 50% de barricas novas de carvalho francês, durante 16 meses.

ANÁLISE DO VINHO
Álcool: 14% vol. / Acidez Total: 5,9 g/l / pH: 3,54

COR
Opaca

NOTA DE PROVAS
Vinho de cor carregada e opaca, com intensa tonalidade violeta.
Aromas frescos e ricos, com notas de fruta preta madura bem casadas com algumas notas de chocolate e especiarias provenientes do estágio em barrica. Na boca, apresenta uma boa estrutura com taninos maduros, o que confere ao vinho um excelente corpo e um grande potencial para envelhecimento em garrafa. O final de boca é rico, elegante e persistente.

ATUALMENTE DISPONÍVEL EM
750 ml

PRÉMIOS

Colheita de 2012 Wine Enthusiast - 91 Points
Colheita de 2012 Asia Wine Trophy 2016 - Gold
Colheita de 2012 Prodexpo Wine Competition 2016 - Gold
Colheita de 2012 Sélections Mondiales des Vins 2015 – Gold
Colheita de 2012 Mundus Vini 2015 – Gold
Colheita de 2012 Asia Wine Trophy 2015 - Gold
Colheita de 2011 Challenge International du Vin 2014 – Gold
Colheita de 2011 Citadelles du Vin 2014 – Gold
Colheita de 2011 Concurso Vinhos de Portugal 2014 – Grand Gold Medal

3 Data

3a. Correlation between familiarity and wines

$means

	GlobalEval	rank	std	r	Min	Max	Q25	Q50	Q75
W1.1	2.636364	222.5000	1.2702899	33	1	5	2.00	2.0	3.00
W1.2	3.250000	311.5625	1.0776318	32	1	5	2.00	3.0	4.00
W1.3	3.852941	403.6912	0.7439596	34	2	5	4.00	4.0	4.00
W1.4	3.368421	327.8421	0.9130008	38	2	5	3.00	3.0	4.00
W1.5	4.333333	472.5000	0.5163978	6	4	5	4.00	4.0	4.75
W2.1	2.433962	202.1226	1.0471469	53	1	4	2.00	2.0	3.00
W2.2	2.818182	252.5000	0.9504783	33	1	4	2.00	3.0	4.00
W2.3	3.121212	301.1364	0.9923953	33	1	4	3.00	3.0	4.00
W2.4	3.529412	355.7647	0.7998162	17	2	5	3.00	4.0	4.00
W2.5	4.000000	419.2857	0.8164966	7	3	5	3.50	4.0	4.50
W3.1	2.088889	155.5556	0.9728641	45	1	4	1.00	2.0	3.00
W3.2	2.475000	201.8875	0.9604353	40	1	5	2.00	2.0	3.00
W3.3	3.093750	289.7969	0.8929608	32	1	5	2.75	3.0	4.00
W3.4	3.500000	347.0227	0.9128709	22	2	5	3.00	3.5	4.00
W3.5	3.750000	379.3750	0.9574271	4	3	5	3.00	3.5	4.25
W4.1	2.260870	182.6957	1.2510865	23	1	5	1.00	2.0	3.00
W4.2	2.454545	205.7273	1.2238609	22	1	5	2.00	2.0	3.75
W4.3	3.277778	315.6944	0.8145502	36	1	5	3.00	3.0	4.00
W4.4	3.837209	398.4535	0.8709664	43	2	5	3.00	4.0	4.00
W4.5	4.315789	466.0000	0.7492686	19	2	5	4.00	4.0	5.00

$groups

	GlobalEval	groups
W1.5	472.5000	a
W4.5	466.0000	a
W2.5	419.2857	ab
W1.3	403.6912	ab
W4.4	398.4535	ab
W3.5	379.3750	abc
W2.4	355.7647	abc
W3.4	347.0227	bc
W1.4	327.8421	bc
W4.3	315.6944	bc
W1.2	311.5625	bc
W2.3	301.1364	c
W3.3	289.7969	c
W2.2	252.5000	cd
W1.1	222.5000	d
W4.2	205.7273	de
W2.1	202.1226	de
W3.2	201.8875	de
W4.1	182.6957	de
W3.1	155.5556	e

$means

	Cor	rank	std	r	Min	Max	Q25	Q50	Q75
W1.1	3.545455	270.9091	1.0028369	33	2	5	3.0	4.0	4.00
W1.2	3.312500	231.4688	0.8957786	32	2	5	3.0	3.0	4.00
W1.3	3.529412	270.2500	0.9919462	34	1	5	3.0	4.0	4.00
W1.4	3.684211	287.8684	0.8089120	38	2	5	3.0	4.0	4.00
W1.5	4.166667	375.2500	1.1690452	6	2	5	4.0	4.5	5.00
W2.1	3.377358	242.2830	0.9652902	53	2	5	3.0	3.0	4.00
W2.2	3.484848	266.8636	1.2021130	33	1	5	3.0	3.0	5.00
W2.3	3.575758	274.7424	0.9364262	33	2	5	3.0	4.0	4.00
W2.4	3.470588	258.1765	0.9432422	17	2	5	3.0	4.0	4.00
W2.5	4.142857	362.1429	0.8997354	7	3	5	3.5	4.0	5.00
W3.1	3.444444	264.9222	1.2350111	45	1	5	3.0	4.0	4.00
W3.2	3.050000	203.2875	1.1082442	40	1	5	2.0	3.0	4.00
W3.3	3.375000	250.6094	1.1845783	32	1	5	2.0	3.0	4.00
W3.4	3.500000	262.5227	1.0578505	22	2	5	3.0	3.0	4.00
W3.5	3.750000	309.8750	1.2583057	4	2	5	3.5	4.0	4.25
W4.1	4.000000	340.9783	0.8528029	23	2	5	3.5	4.0	5.00
W4.2	3.863636	320.2500	0.9408939	22	2	5	3.0	4.0	4.75
W4.3	4.083333	354.5972	0.7699722	36	2	5	4.0	4.0	5.00
W4.4	4.162791	371.8953	0.8709664	43	1	5	4.0	4.0	5.00
W4.5	4.736842	462.1842	0.5619515	19	3	5	5.0	5.0	5.00

$groups

	Cor	groups
W4.5	462.1842	a
W1.5	375.2500	ab
W4.4	371.8953	b
W2.5	362.1429	b
W4.3	354.5972	b
W4.1	340.9783	b
W4.2	320.2500	b
W3.5	309.8750	bc
W1.4	287.8684	bc
W2.3	274.7424	bc
W1.1	270.9091	bc
W1.3	270.2500	bc
W2.2	266.8636	bc
W3.1	264.9222	bc
W3.4	262.5227	bc
W2.4	258.1765	bc
W3.3	250.6094	bc
W2.1	242.2830	c
W1.2	231.4688	c
W3.2	203.2875	c

$means

	Init	rank	std	r	Min	Max	Q25	Q50	Q75
W1.1	3.030303	262.1818	1.1035411	33	1	5	2.00	3.0	4.00

```
W1.2 3.250000 302.2031 1.0776318 32   1   5 2.75 4.0 4.00
W1.3 3.323529 301.3529 0.8780346 34   2   5 3.00 3.0 4.00
W1.4 3.473684 329.3289 1.0328874 38   1   5 3.00 4.0 4.00
W1.5 4.000000 408.5833 0.6324555  6   3   5 4.00 4.0 4.00
W2.1 2.320755 164.7075 0.9761302 53   1   5 2.00 2.0 3.00
W2.2 2.727273 219.3030 1.1530592 33   1   5 2.00 3.0 3.00
W2.3 2.878788 243.8485 0.9923953 33   1   4 2.00 3.0 4.00
W2.4 3.411765 319.0000 1.0641207 17   2   5 2.00 4.0 4.00
W2.5 4.285714 452.2143 0.4879500  7   4   5 4.00 4.0 4.50
W3.1 2.644444 208.2222 1.0259265 45   1   5 2.00 2.0 3.00
W3.2 2.825000 233.4375 1.0594508 40   1   5 2.00 3.0 4.00
W3.3 3.031250 262.3594 0.8974651 32   1   4 2.00 3.0 4.00
W3.4 3.318182 305.5909 0.9454837 22   2   5 2.25 4.0 4.00
W3.5 4.000000 404.6250 0.8164966  4   3   5 3.75 4.0 4.25
W4.1 3.260870 298.4565 1.2510865 23   1   5 2.00 3.0 4.00
W4.2 3.409091 320.8182 1.2968493 22   1   5 2.25 4.0 4.00
W4.3 3.555556 336.3611 0.7725448 36   2   5 3.00 3.5 4.00
W4.4 3.930233 397.0233 0.8562195 43   1   5 4.00 4.0 4.00
W4.5 4.578947 483.8684 0.6924826 19   3   5 4.00 5.0 5.00

$groups
         Init groups
W4.5 483.8684      a
W2.5 452.2143     ab
W1.5 408.5833    abc
W3.5 404.6250   abcd
W4.4 397.0233    bcd
W4.3 336.3611    bcd
W1.4 329.3289     cd
W4.2 320.8182    cde
W2.4 319.0000    cde
W3.4 305.5909   cdef
W1.2 302.2031   cdef
W1.3 301.3529   cdef
W4.1 298.4565   cdef
W3.3 262.3594   defg
W1.1 262.1818   defg
W2.3 243.8485    efg
W3.2 233.4375     fg
W2.2 219.3030     gh
W3.1 208.2222     gh
W2.1 164.7075      h

$means
       Expect     rank       std  r Min Max  Q25 Q50  Q75
W1.1 2.969697 260.7121 1.1315048 33   1   5 2.00 3.0 4.00
W1.2 3.062500 275.5781 1.0757593 32   1   5 2.00 3.0 4.00
W1.3 3.470588 337.1029 0.8251830 34   2   5 3.00 3.5 4.00
W1.4 3.078947 281.4211 0.9118315 38   1   5 3.00 3.0 4.00
```

```
W1.5 4.166667 451.0000 0.4082483  6   4   5 4.00 4.0 4.00
W2.1 2.396226 181.0094 1.0802354 53   1   5 2.00 2.0 3.00
W2.2 2.757576 231.2727 1.1997474 33   1   5 2.00 3.0 3.00
W2.3 3.030303 274.4697 1.0748502 33   1   5 2.00 3.0 4.00
W2.4 3.411765 331.6765 1.0641207 17   1   5 3.00 4.0 4.00
W2.5 4.000000 414.3571 0.8164966  7   3   5 3.50 4.0 4.50
W3.1 2.666667 216.8667 0.9534626 45   1   5 2.00 3.0 3.00
W3.2 2.850000 247.6875 1.0265701 40   1   5 2.00 3.0 4.00
W3.3 3.062500 272.5000 0.9482582 32   2   5 2.00 3.0 4.00
W3.4 3.227273 302.0682 1.0660036 22   1   5 2.25 3.0 4.00
W3.5 4.000000 416.6250 0.8164966  4   3   5 3.75 4.0 4.25
W4.1 2.913043 259.1522 1.3112466 23   1   5 2.00 3.0 4.00
W4.2 3.318182 318.2273 1.1705255 22   1   5 3.00 3.5 4.00
W4.3 3.555556 350.5139 0.9085135 36   1   5 3.00 4.0 4.00
W4.4 3.674419 368.8721 0.8372554 43   2   5 3.00 4.0 4.00
W4.5 4.263158 454.3421 0.9911893 19   1   5 4.00 4.0 5.00

$groups
       Expect groups
W4.5 454.3421      a
W1.5 451.0000     ab
W3.5 416.6250    abc
W2.5 414.3571    abc
W4.4 368.8721     bc
W4.3 350.5139     bc
W1.3 337.1029     bc
W2.4 331.6765    bcd
W4.2 318.2273   bcde
W3.4 302.0682   cdef
W1.4 281.4211   cdef
W1.2 275.5781  cdefg
W2.3 274.4697  cdefg
W3.3 272.5000  cdefg
W1.1 260.7121   defg
W4.1 259.1522   defg
W3.2 247.6875    efg
W2.2 231.2727    fgh
W3.1 216.8667     gh
W2.1 181.0094      h


$means
      Impress     rank       std  r Min Max Q25 Q50  Q75
W1.1 2.787879 253.9242 1.3171365 33   1   5 2.0 3.0 4.00
W1.2 3.281250 324.3750 1.1425601 32   1   5 2.0 3.5 4.00
W1.3 3.764706 396.8382 0.8186768 34   2   5 3.0 4.0 4.00
W1.4 3.394737 342.4737 1.0010663 38   0   5 3.0 3.0 4.00
W1.5 4.000000 434.1667 0.6324555  6   3   5 4.0 4.0 4.00
W2.1 2.509434 212.4623 1.0673951 53   1   5 2.0 2.0 3.00
W2.2 2.757576 243.8788 0.8302975 33   1   4 2.0 3.0 3.00
W2.3 3.090909 300.9697 1.0417424 33   1   5 3.0 3.0 4.00
W2.4 3.647059 381.7059 0.7018882 17   2   5 3.0 4.0 4.00
W2.5 3.571429 374.6429 0.7867958  7   2   4 3.5 4.0 4.00
```

```
W3.1 2.133333 163.0333 0.9908674 45   1   4 1.0 2.0 3.00
W3.2 2.500000 209.7125 0.9870962 40   1   5 2.0 3.0 3.00
W3.3 2.843750 258.9688 0.9873188 32   1   5 2.0 3.0 3.25
W3.4 3.545455 363.3636 0.9625004 22   1   5 3.0 4.0 4.00
W3.5 3.750000 385.1250 0.9574271  4   3   5 3.0 3.5 4.25
W4.1 2.347826 196.8913 1.1122743 23   1   4 1.0 2.0 3.00
W4.2 2.500000 216.3636 1.1019463 22   1   4 2.0 2.5 3.00
W4.3 3.055556 285.6111 0.8600480 36   1   5 3.0 3.0 3.25
W4.4 3.604651 370.6163 0.9546761 43   1   5 3.0 4.0 4.00
W4.5 4.157895 452.7105 0.7647191 19   2   5 4.0 4.0 5.
```

```
$groups
      Impress groups
W4.5 452.7105      a
W1.5 434.1667     ab
W1.3 396.8382     ab
W3.5 385.1250    abc
W2.4 381.7059    abc
W2.5 374.6429    abc
W4.4 370.6163     bc
W3.4 363.3636     bc
W1.4 342.4737     bc
W1.2 324.3750     bc
W2.3 300.9697      c
W4.3 285.6111     cd
W3.3 258.9688    cde
W1.1 253.9242    cde
W2.2 243.8788    cde
W4.2 216.3636    def
W2.1 212.4623     ef
W3.2 209.7125     ef
W4.1 196.8913     ef
W3.1 163.0333      f
```

3b. Correlation between familiarity and sex

```
$means
    GlobalEval     rank       std  r Min Max  Q25 Q50  Q75
F.1   2.271605 181.0864 1.1512205 81   1   5 1.00 2.0 3.00
F.2   2.833333 254.4924 1.0165300 66   1   5 2.00 3.0 4.00
F.3   3.359375 331.8516 0.9489708 64   1   5 3.00 4.0 4.00
F.4   3.693878 377.1939 0.8709210 49   2   5 3.00 4.0 4.00
F.5   3.950000 414.0750 0.8255779 20   2   5 3.75 4.0 4.25
M.1   2.438356 199.8493 1.0799473 73   1   5 2.00 2.0 3.00
M.2   2.672131 231.2705 1.1360944 61   1   5 2.00 2.0 4.00
M.3   3.323944 324.8310 0.8746370 71   1   5 3.00 3.0 4.00
M.4   3.507042 349.1761 0.9082674 71   2   5 3.00 4.0 4.00
M.5   4.500000 491.2500 0.5163978 16   4   5 4.00 4.5 5.00
```

```
$groups
    GlobalEval groups
M.5   491.2500      a
F.5   414.0750     ab
F.4   377.1939     bc
M.4   349.1761    bcd
F.3   331.8516     cd
M.3   324.8310      d
F.2   254.4924      e
M.2   231.2705     ef
M.1   199.8493     fg
F.1   181.0864      g
```

```
$means
         Cor     rank       std  r Min Max Q25 Q50 Q75
F.1 3.654321 292.1543 1.1419336 81   1   5   3   4   5
F.2 3.272727 232.8712 1.1030790 66   1   5   3   3   4
F.3 3.562500 279.5469 1.1391308 64   1   5   3   4   4
F.4 3.775510 308.0306 1.0260220 49   1   5   3   4   5
F.5 4.250000 385.4250 1.0195458 20   2   5   4   5   5
M.1 3.383562 244.9384 0.9373446 73   1   5   3   3   4
M.2 3.475410 262.6393 1.0584038 61   1   5   3   4   4
M.3 3.732394 297.8732 0.8611910 71   2   5   3   4   4
M.4 3.802817 309.8803 0.8721028 71   2   5   3   4   4
```

```
$groups
         Cor groups
M.5 443.6875      a
F.5 385.4250     ab
M.4 309.8803     bc
F.4 308.0306     bc
M.3 297.8732      c
F.1 292.1543     cd
F.3 279.5469    cde
M.2 262.6393    cde
M.1 244.9384     de
F.2 232.8712      e
```

```
$means
        Init     rank       std  r Min Max Q25 Q50 Q75
F.1 2.740741 225.2654 1.2122064 81   1   5   2   3   4
F.2 2.878788 243.4318 1.1165214 66   1   5   2   3   4
F.3 3.250000 295.1328 0.9920317 64   1   5   3   3   4
F.4 3.693878 364.4592 1.0449099 49   1   5   3   4   4
F.5 4.300000 449.2500 0.6569467 20   3   5   4   4   5
M.1 2.671233 210.5411 0.9867848 73   1   5   2   3   3
M.2 3.147541 282.5656 1.1809045 61   1   5   2   3   4
M.3 3.169014 280.4085 0.8449161 71   1   5   3   3   4
M.4 3.535211 336.2535 0.9385549 71   2   5   3   4   4
M.5 4.437500 465.2500 0.7274384 16   3   5   4   5   5

$groups
        Init groups
M.5 465.2500      a
F.5 449.2500      a
F.4 364.4592      b
M.4 336.2535     bc
F.3 295.1328     cd
M.2 282.5656     de
M.3 280.4085     de
F.2 243.4318     ef
F.1 225.2654      f
M.1 210.5411      f

$means
      Expect     rank       std  r Min Max  Q25 Q50 Q75
F.1 2.679012 222.8827 1.2229796 81   1   5 2.00   3   3
F.2 2.833333 242.4924 1.0315535 66   1   5 2.00   3   3
F.3 3.281250 307.4766 0.9834947 64   1   5 3.00   3   4
F.4 3.326531 319.4694 1.0080459 49   1   5 3.00   3   4
F.5 3.800000 393.7750 0.8944272 20   1   5 3.75   4   4
M.1 2.671233 217.3014 0.9726081 73   1   5 2.00   3   3
M.2 3.098361 284.5000 1.1931040 61   1   5 2.00   3   4
M.3 3.295775 312.3803 0.9470913 71   1   5 3.00   3   4
M.4 3.394366 326.5563 0.9331800 71   1   5 3.00   3   4
M.5 4.625000 501.8750 0.5000000 16   4   5 4.00   5   5

$groups
      Expect groups
M.5 501.8750      a
F.5 393.7750      b
M.4 326.5563     bc
F.4 319.4694     bc
M.3 312.3803      c
F.3 307.4766      c
M.2 284.5000     cd
F.2 242.4924     de
F.1 222.8827      e
M.1 217.3014      e
```

```
$means
     Impress     rank       std  r Min Max Q25 Q50 Q75
F.1 2.382716 199.3272 1.1892004 81   1   5   1   2   3
F.2 2.833333 257.1061 0.9700648 66   1   5   2   3   3
F.3 3.171875 307.9688 1.0166032 64   1   5   3   3   4
F.4 3.632653 380.5306 0.9507426 49   0   5   3   4   4
F.5 3.650000 383.8250 0.7451598 20   2   5   3   4   4
M.1 2.493151 210.4041 1.0557158 73   1   5   2   2   3
M.2 2.688525 239.4672 1.1334458 61   1   5   2   3   4
M.3 3.211268 313.8521 0.9549195 71   1   5   3   3   4
M.4 3.464789 349.1197 0.9232085 71   1   5   3   3   4
M.5 4.375000 480.8125 0.6191392 16   3   5   4   4   5

$groups
     Impress groups
M.5 480.8125      a
F.5 383.8250      b
F.4 380.5306      b
M.4 349.1197     bc
M.3 313.8521     bc
F.3 307.9688      c
F.2 257.1061      d
M.2 239.4672     de
M.1 210.4041     de
F.1 199.3272      e
```

3c. Correlation between familiarity and age

```
$means
    GlobalEval     rank       std  r Min Max Q25 Q50 Q75
A.1   2.682927 235.0854 1.1640505 82   1   5   2   3   4
A.2   2.985714 277.7929 1.1608700 70   1   5   2   3   4
A.3   3.410959 337.1301 0.8949801 73   1   5   3   3   4
A.4   3.647059 369.1029 0.8597936 68   2   5   3   4   4
A.5   4.096774 436.0161 0.7463171 31   2   5   4   4   5
B.1   1.972222 138.6111 0.9340540 72   1   5   1   2   2
B.2   2.473684 201.0263 0.8885233 57   1   4   2   2   3
B.3   3.258065 317.5968 0.9221408 62   1   5   3   3   4
B.4   3.500000 349.5192 0.9393364 52   2   5   3   4   4
B.5   4.800000 525.0000 0.4472136  5   4   5   5   5   5
```

```
$groups
    GlobalEval groups
B.5   525.0000      a
A.5   436.0161      a
A.4   369.1029      b
B.4   349.5192     bc
A.3   337.1301     bc
B.3   317.5968     cd
A.2   277.7929     de
A.1   235.0854     ef
B.2   201.0263      f
B.1   138.6111      g
```

```
$means
         Cor     rank       std  r Min Max Q25 Q50  Q75
A.1 3.634146 288.2805 1.0831162 82   1   5   3   4 4.00
A.2 3.500000 269.0643 1.1261065 70   1   5   3   4 4.00
A.3 3.684932 294.9795 0.9982862 73   1   5   3   4 4.00
A.4 3.823529 313.4706 0.8967799 68   2   5   3   4 4.00
A.5 4.322581 396.0484 0.9087389 31   2   5   4   5 5.00
B.1 3.402778 248.6944 1.0162028 72   1   5   3   3 4.00
B.2 3.210526 220.2807 1.0130725 57   1   5   3   3 4.00
B.3 3.612903 282.3629 1.0139169 62   1   5   3   4 4.00
B.4 3.750000 303.4423 0.9876691 52   1   5   3   4 4.25
B.5 5.000000 506.0000 0.0000000  5   5   5   5   5 5.00
```

```
$groups
         Cor groups
B.5 506.0000      a
A.5 396.0484      a
A.4 313.4706      b
B.4 303.4423     bc
A.3 294.9795     bc
A.1 288.2805     bc
B.3 282.3629     bc
A.2 269.0643    bcd
B.1 248.6944     cd
B.2 220.2807      d
```

```
$means
        Init     rank       std  r Min Max  Q25 Q50 Q75
A.1 2.817073 234.8232 1.1453400 82   1   5 2.00   3   4
A.2 3.271429 302.7500 1.1662081 70   1   5 2.25   4   4
A.3 3.191781 286.6027 0.9076455 73   1   5 3.00   3   4
A.4 3.705882 362.3088 0.9628754 68   1   5 3.00   4   4
A.5 4.322581 450.6935 0.7017643 31   3   5 4.00   4   5
B.1 2.583333 199.4514 1.0581674 72   1   5 2.00   2   3
B.2 2.684211 212.4649 1.0548848 57   1   5 2.00   3   3
B.3 3.225806 288.3145 0.9307032 62   1   5 3.00   3   4
B.4 3.461538 328.7596 0.9992456 52   1   5 3.00   4   4
B.5 4.600000 491.5000 0.5477226  5   4   5 4.00   5   5

$groups
        Init groups
B.5 491.5000      a
A.5 450.6935      a
A.4 362.3088     ab
B.4 328.7596     bc
A.2 302.7500      c
B.3 288.3145      c
A.3 286.6027      c
A.1 234.8232      d
B.2 212.4649      d
B.1 199.4514      d

$means
      Expect     rank       std  r Min Max Q25 Q50 Q75
A.1 2.841463 243.9939 1.0118985 82   1   5   2   3   3
A.2 3.271429 310.1143 1.1283106 70   1   5   3   3   4
A.3 3.369863 323.8836 1.0207139 73   1   5   3   4   4
A.4 3.411765 328.6103 0.9016617 68   1   5   3   3   4
A.5 4.225806 449.3710 0.6688137 31   3   5   4   4   5
B.1 2.486111 193.1806 1.1866992 72   1   5   2   2   3
B.2 2.578947 204.4035 0.9810229 57   1   5   2   3   3
B.3 3.193548 293.7742 0.8840798 62   1   5   3   3   4
B.4 3.307692 317.1923 1.0392015 52   1   5   3   4   4
B.5 3.800000 395.0000 1.6431677  5   1   5   4   4   5

$groups
      Expect groups
A.5 449.3710      a
B.5 395.0000     ab
A.4 328.6103      b
A.3 323.8836      b
B.4 317.1923      b
A.2 310.1143      b
B.3 293.7742      b
A.1 243.9939      c
B.2 204.4035     cd
B.1 193.1806      d
```

$means

	Impress	rank	std	r	Min	Max	Q25	Q50	Q75
A.1	2.804878	258.7439	1.1909020	82	1	5	2	3	4
A.2	2.985714	283.8714	1.1483177	70	1	5	2	3	4
A.3	3.301370	327.0137	1.0094681	73	1	5	3	3	4
A.4	3.691176	384.9412	0.8509407	68	1	5	3	4	4
A.5	3.903226	417.1290	0.7897189	31	2	5	4	4	4
B.1	2.013889	142.8889	0.8800297	72	1	5	1	2	2
B.2	2.491228	205.3596	0.8477451	57	1	4	2	2	3
B.3	3.064516	292.2823	0.9386242	62	1	5	3	3	4
B.4	3.326923	331.8750	1.0043270	52	0	5	3	3	4
B.5	4.400000	487.7000	0.5477226	5	4	5	4	4	5

$groups

	Impress	groups
B.5	487.7000	a
A.5	417.1290	a
A.4	384.9412	a
B.4	331.8750	b
A.3	327.0137	b
B.3	292.2823	bc
A.2	283.8714	bc
A.1	258.7439	c
B.2	205.3596	d
B.1	142.8889	e

3d. Segmentation (Global Evaluation) Results

```
$means
  GlobalEval     rank      std   r Min Max Q25 Q50 Q75
A    3.25000 314.6559 1.102699 324   1   5   3   3   4
B    2.78629 249.7157 1.134075 248   1   5   2   3   4

$groups
  GlobalEval groups
A   314.6559      a
B   249.7157      b


$means
  GlobalEval     rank      std   r Min Max Q25 Q50 Q75
F   3.021429 283.8107 1.157601 280   1   5   2   3   4
M   3.075342 289.0788 1.122011 292   1   5   2   3   4

$groups
  GlobalEval groups
M   289.0788      a
F   283.8107      a


$means
    GlobalEval     rank      std   r Min Max Q25 Q50 Q75
Nao   3.065693 288.8120 1.135786 548   1   5   2 3.0   4
Sim   2.666667 233.7083 1.167184  24   1   5   2 2.5   4

$groups
    GlobalEval groups
Nao   288.8120      a
Sim   233.7083      a


$means
    GlobalEval     rank      std   r Min Max Q25 Q50 Q75
Nao   3.040948 285.5463 1.127146 464   1   5   2   3   4
Sim   3.083333 290.5972 1.192853 108   1   5   2   3   4

$groups
    GlobalEval groups
Sim   290.5972      a
Nao   285.5463      a


$means
    GlobalEval     rank      std   r Min Max Q25 Q50 Q75
Nao   3.032828 284.7942 1.136921 396   1   5   2   3   4
Sim   3.085227 290.3381 1.145729 176   1   5   2   3   4


$groups
    GlobalEval groups
Sim   290.3381      a
Nao   284.7942      a
```

```
$means           GlobalEval     rank      std   r Min Max Q25 Q50 Q75
Interessado    3.102113 293.5687 1.134176 284   1   5   2   3   4
Novato         2.996528 279.5295 1.143070 288   1   5   2   3   4

$groups
           GlobalEval groups
Interessado   293.5687      a
Novato        279.5295      a


$means
            GlobalEval     rank      std   r Min Max Q25 Q50 Q75
1 a 3 vezes   3.127907 296.9884 1.117541 344   1   5   2   3   4
Diariamente   3.000000 277.7604 1.036187  96   1   5   2   3   4
Nunca         2.878788 265.5227 1.248084 132   1   5   2   3   4

$groups
            GlobalEval groups
1 a 3 vezes   296.9884      a
Diariamente   277.7604      a
Nunca         265.5227      a


$means               GlobalEval     rank      std   r Min Max Q25 Q50
Q75
Hypersensitive   3.128571 297.9643 1.143281 140   1   5   2   3   4
ND               2.764706 246.7794 1.187810 136   1   5   2   3   4
Sensitive        3.175781 304.0762 1.075739 256   1   5   2   3   4
Tolerant         2.925000 268.9375 1.206553  40   1   5   2   3   4

$groups
               GlobalEval groups
Sensitive        304.0762      a
Hypersensitive   297.9643      a
Tolerant         268.9375     ab
ND               246.7794      b


$means
   GlobalEval     rank      std   r Min Max Q25 Q50 Q75
A    3.050459 286.9518 1.143588 436   1   5   2   3   4
NA   3.044118 285.0515 1.127880 136   1   5   2   3   4

$groups
   GlobalEval groups
A    286.9518      a
NA   285.0515      a


$means
   GlobalEval     rank      std   r Min Max Q25 Q50 Q75
NT   2.994318 279.9176 1.153861 176   1   5   2   3   4
ST   3.030488 283.7896 1.250393 164   1   5   2   3   4
T    3.103448 293.4095 1.043465 232   1   5   2   3   4

$groups
```

```
   GlobalEval groups
T    293.4095      a
ST   283.7896      a
NT   279.9176      a
```

```
$means
            GlobalEval     rank      std   r Min Max Q25 Q50 Q75
NaoTreinado   3.015909 281.3330 1.158202 440   1   5   2   3   4
Treinado      3.159091 303.7235 1.068848 132   1   5   2   3   4

$groups
           GlobalEval groups
Treinado      303.7235      a
NaoTreinado   281.3330      a
```

```
$means
   GlobalEval     rank      std   r Min Max Q25 Q50 Q75
W1   3.328671 323.9930 1.092717 143   1   5   2   3   4
W2   2.888112 265.4930 1.062185 143   1   5   2   3   4
W3   2.685315 234.2727 1.077422 143   1   5   2   3   3
W4   3.293706 322.2413 1.197604 143   1   5   2   4   4

$groups
   GlobalEval groups
W1   323.9930      a
W4   322.2413      a
W2   265.4930      b
W3   234.2727      b
```

```
$means
  GlobalEval     rank       std   r Min Max  Q25 Q50 Q75
1   2.350649 189.9805 1.1174929 154   1   5 1.25   2   3
2   2.755906 243.3386 1.0743513 127   1   5 2.00   3   4
3   3.340741 328.1593 0.9073741 135   1   5 3.00   3   4
4   3.583333 360.6167 0.8942706 120   2   5 3.00   4   4
5   4.194444 448.3750 0.7490735  36   2   5 4.00   4   5

$groups
  GlobalEval groups
5   448.3750      a
4   360.6167      b
3   328.1593      b
2   243.3386      c
1   189.9805      d
```

3e. Segmentation (Colour Impression) Results

```
$means
       Cor     rank      std   r Min Max Q25 Q50 Q75
A 3.722222 301.2361 1.039469 324   1   5   3 4.0   5
B 3.516129 267.2480 1.033714 248   1   5   3 3.5   4

$groups
       Cor groups
A 301.2361      a
B 267.2480      b


$means
                 Cor     rank      std   r Min Max Q25 Q50 Q75
Interessado 3.633803 287.3345 1.059894 284   1   5   3   4   4
Novato      3.631944 285.6771 1.024076 288   1   5   3   4   4

$groups
                Cor groups
Interessado 287.3345      a
Novato      285.6771      a


$means
                    Cor     rank       std   r Min Max Q25 Q50 Q75
Hypersensitive 3.721429 297.8143 0.9450199 140   1   5   3   4   4
ND             3.272059 230.0809 1.0217408 136   1   5   3   3   4
Sensitive      3.738281 304.9277 1.0727733 256   1   5   3   4   5
Tolerant       3.875000 320.7875 0.9657600  40   2   5   3   4   5


$groups
                    Cor groups
Tolerant       320.7875      a
Sensitive      304.9277      a
Hypersensitive 297.8143      a
ND             230.0809      b

$means
       Cor     rank       std   r Min Max Q25 Q50 Q75
W1 3.552448 270.8112 0.9395708 143   1   5   3   4   4
W2 3.496503 263.2028 1.0131121 143   1   5   3   3   4
W3 3.335664 245.3671 1.1624649 143   1   5   2   3   4
W4 4.146853 366.6189 0.8471829 143   1   5   4   4   5

$groups
       Cor groups
W4 366.6189      a
W1 270.8112      b
W2 263.2028      b
W3 245.3671      b


$means
```

```
       Cor     rank      std   r Min Max Q25 Q50 Q75
F 3.607143 284.7393 1.124484 280   1   5   3   4   5
M 3.657534 288.1884 0.955637 292   1   5   3   4   4
```

```
$groups
       Cor groups
M 288.1884      a
F 284.7393      a
```

```
         Cor     rank      std   r Min Max Q25 Q50  Q75
Nao 3.627737 285.6880 1.042128 548   1   5   3   4 4.00
Sim 3.750000 305.0417 1.032094  24   2   5   3   4 4.25
```

```
$groups
         Cor groups
Sim 305.0417      a
Nao 285.6880      a
```

```
$means
         Cor     rank      std   r Min Max Q25 Q50 Q75
Nao 3.590517 280.0172 1.031050 464   1   5   3   4   4
Sim 3.814815 314.3519 1.069091 108   2   5   3   4   5
```

```
$groups
         Cor groups
Sim 314.3519      a
Nao 280.0172      b
```

```
$means
         Cor     rank      std   r Min Max Q25 Q50 Q75
Nao 3.671717 291.8245 1.017969 396   1   5   3   4   4
Sim 3.545455 274.5199 1.089263 176   1   5   3   4   4
```

```
$groups
         Cor groups
Nao 291.8245      a
Sim 274.5199      a
```

```
$means
                Cor     rank       std   r Min Max Q25 Q50  Q75
1 a 3 vezes 3.616279 284.6715 1.0708826 344   1   5   3   4 4.00
Diariamente 3.541667 272.8594 1.0251230  96   1   5   3   4 4.00
Nunca       3.742424 301.1856 0.9699391 132   1   5   3   4 4.25
```

```
$groups
                Cor groups
Nunca       301.1856      a
1 a 3 vezes 284.6715      a
Diariamente 272.8594      a
```

```
$means
        Cor     rank      std   r Min Max Q25 Q50 Q75
```

```
A  3.628440 286.0986 1.054609 436   1   5   3   4   4
NA 3.647059 287.7868 1.000218 136   1   5   3   4   4

$groups
        Cor groups
NA 287.7868      a
A  286.0986      a


$means
        Cor     rank      std   r Min Max Q25 Q50  Q75
NT 3.590909 281.2472 1.054366 176   1   5   3   4 4.00
ST 3.658537 290.6250 1.053414 164   1   5   3   4 4.25
T  3.646552 287.5690 1.025682 232   1   5   3   4 4.00

$groups
        Cor groups
ST 290.6250      a
T  287.5690      a
NT 281.2472      a

$means
                Cor     rank      std   r Min Max Q25 Q50 Q75
NaoTreinado 3.570455 277.1511 1.045454 440   1   5   3   4   4
Treinado    3.840909 317.6629 1.002512 132   2   5   3   4   5

$groups
                Cor groups
Treinado    317.6629      a
NaoTreinado 277.1511      b

$means
       Cor     rank       std   r Min Max Q25 Q50 Q75
1 3.525974 269.7727 1.0553199 154   1   5   3   4   4
2 3.370079 247.1693 1.0823486 127   1   5   3   3   4
3 3.651852 289.1852 1.0023742 135   1   5   3   4   4
4 3.791667 309.1250 0.9339159 120   1   5   3   4   4
5 4.416667 411.3194 0.8742344  36   2   5   4   5   5
$groups
       Cor groups
5 411.3194      a
4 309.1250      b
3 289.1852     bc
1 269.7727     cd
2 247.1693
```

3f. Segmentation (Initial Odour Impression) Results

```
$means
      Init     rank      std   r Min Max Q25 Q50 Q75
A 3.330247 308.5756 1.112362 324   1   5   3 3.5   4
B 2.991935 257.6593 1.087254 248   1   5   2 3.0   4

$groups
      Init groups
A 308.5756      a
B 257.6593      b
```

```
$means               Init     rank      std   r Min Max Q25 Q50 Q75
Interessado 3.242958 294.6866 1.143789 284   1   5   2   3   4
Novato      3.125000 278.4271 1.081198 288   1   5   2   3   4

$groups
                Init groups
Interessado 294.6866      a
Novato      278.4271      a
```

```
$means
                   Init     rank      std   r Min Max  Q25 Q50 Q75
Hypersensitive 3.200000 290.0000 1.132896 140   1   5 2.00 3.0   4
ND             2.845588 235.3603 1.067213 136   1   5 2.00 3.0   4
Sensitive      3.343750 310.4258 1.102137 256   1   5 3.00 3.5   4
Tolerant       3.250000 295.0000 1.056118  40   1   5 2.75 3.0   4

$groups
                   Init groups
Sensitive      310.4258      a
Tolerant       295.0000      a
Hypersensitive 290.0000      a
ND             235.3603      b
```

```
$means
       Init     rank      std   r Min Max Q25 Q50 Q75
W1 3.307692 304.4371 1.022499 143   1   5   3   3 4.0
W2 2.769231 227.9860 1.117671 143   1   5   2   3 4.0
W3 2.923077 247.8636 1.021439 143   1   5   2   3 4.0
W4 3.734266 365.7133 1.041066 143   1   5   3   4 4.5

$groups
       Init groups
W4 365.7133      a
W1 304.4371      b
W3 247.8636      c
```

```
W2 227.9860      c
```

```
$means
      Init     rank      std   r Min Max Q25 Q50 Q75
F 3.167857 285.8750 1.168755 280   1   5   2   3   4
M 3.198630 287.0993 1.059208 292   1   5   2   3   4

$groups
      Init groups
M 287.0993      a
F 285.8750      a
```

```
$means
       Init     rank      std   r Min Max Q25 Q50 Q75
Nao 3.19708 288.2108 1.102362 548   1   5   2   3   4
Sim 2.87500 247.4375 1.329024  24   1   5   2   3   4

$groups
        Init groups
Nao 288.2108      a
Sim 247.4375      a
```

```
$means
        Init    rank      std   r Min Max Q25 Q50 Q75
Nao 3.135776 279.625 1.111928 464   1   5   2   3   4
Sim 3.388889 316.037 1.100835 108   1   5   3   4   4

$groups
       Init groups
Sim 316.037      a
Nao 279.625      b
```

```
$means
        Init     rank      std   r Min Max Q25 Q50 Q75
Nao 3.148990 282.0997 1.114018 396   1   5   2   3   4
Sim 3.261364 296.4006 1.110926 176   1   5   2   3   4

$groups
        Init groups
Sim 296.4006      a
Nao 282.0997      a
```

```
$means
                Init     rank      std   r Min Max Q25 Q50 Q75
1 a 3 vezes 3.226744 292.7282 1.109611 344   1   5   2   3   4
Diariamente 3.135417 278.5573 1.022070  96   1   5   2   3   4
Nunca       3.106061 276.0455 1.186808 132   1   5   2   3   4

$groups
                Init groups
1 a 3 vezes 292.7282      a
Diariamente 278.5573      a
Nunca       276.0455      a
```

```
$means
       Init     rank      std   r Min Max Q25 Q50 Q75
A  3.199541 288.5642 1.117921 436   1   5   2   3   4
NA 3.132353 279.8824 1.100901 136   1   5   2   3   4


$groups
       Init groups
A  288.5642      a
NA 279.8824      a


$means
       Init     rank       std   r Min Max Q25 Q50 Q75
NT 3.000000 258.3040 0.9971388 176   1   5   2   3   4
ST 3.231707 293.7561 1.2164393 164   1   5   2   3   4
T  3.288793 302.7608 1.1081181 232   1   5   2   3   4


$groups
       Init groups
T  302.7608      a
ST 293.7561      a
NT 258.3040      b


$means
                Init     rank       std   r Min Max Q25 Q50 Q75
NaoTreinado 3.097727 274.4659 1.1382736 440   1   5   2   3   4
Treinado    3.469697 326.6136 0.9763571 132   1   5   3   4   4

$groups
                Init groups
Treinado    326.6136      a
NaoTreinado 274.4659      b


$means
      Init     rank       std   r Min Max Q25 Q50  Q75
1 2.707792 218.2857 1.1080533 154   1   5   2   3 3.75
2 3.007874 262.2283 1.1512317 127   1   5   2   3 4.00
3 3.207407 287.3889 0.9150181 135   1   5   3   3 4.00
4 3.600000 347.7708 0.9821944 120   1   5   3   4 4.00
5 4.361111 456.3611 0.6825489  36   3   5   4   4 5.00


$groups
      Init groups
5 456.3611      a
4 347.7708      b
3 287.3889      c
2 262.2283      c
1 218.2857      d
```

3g. Segmentation (Expectation for the Mouthfeel) Results

```
$means
    Expect     rank      std   r Min Max Q25 Q50 Q75
A 3.305556 313.6883 1.053889 324   1   5   3   3   4
B 2.883065 250.9798 1.108686 248   1   5   2   3   4


$groups
    Expect groups
A 313.6883      a
B 250.9798      b


$means
              Expect     rank      std   r Min Max Q25 Q50 Q75
Interessado 3.186620 295.3838 1.097876 284   1   5   2   3   4
Novato      3.059028 277.7396 1.094803 288   1   5   2   3   4

$groups
              Expect groups
Interessado 295.3838      a
Novato      277.7396      a

attr(,"class")
[1] "group"


$means
                 Expect     rank      std   r Min Max Q25 Q50 Q75
Hypersensitive 3.121429 285.6786 1.055768 140   1   5   2   3   4
ND             2.735294 229.2794 1.083446 136   1   5   2   3   3
Sensitive      3.320312 316.7930 1.080549 256   1   5   3   3   4
Tolerant       3.175000 290.0500 1.083383  40   1   5   2   3   4

$groups
                  Expect groups
Sensitive       316.7930      a
Tolerant        290.0500      a
Hypersensitive  285.6786      a
ND              229.2794      b


$means
     Expect     rank       std   r Min Max Q25 Q50 Q75
W1 3.188811 295.6888 0.9996552 143   1   5   3   3   4
W2 2.825175 243.5105 1.1647081 143   1   5   2   3   4
W3 2.930070 256.6329 1.0115554 143   1   5   2   3   4
W4 3.545455 350.1678 1.0728879 143   1   5   3   4   4

$groups
     Expect groups
W4 350.1678      a
W1 295.6888      b
W3 256.6329      c
```

```
W2 243.5105       c
```

```
$means
    Expect     rank      std   r Min Max Q25 Q50 Q75
F 3.046429 275.9500 1.114255 280   1   5   2   3   4
M 3.195205 296.6164 1.077533 292   1   5   2   3   4

$groups
    Expect groups
M 296.6164      a
F 275.9500      a
```

```
$means
      Expect     rank      std   r Min Max Q25 Q50 Q75
Nao 3.135036 288.0931 1.090098 548   1   5   2   3   4
Sim 2.833333 250.1250 1.239448  24   1   5   2   3   4

$groups
      Expect groups
Nao 288.0931      a
Sim 250.1250      a
```

```
$means
      Expect     rank      std   r Min Max  Q25 Q50 Q75
Nao 3.084052 280.9968 1.087651 464   1   5 2.00   3   4
Sim 3.287037 310.1435 1.127821 108   1   5 2.75   3   4

$groups
      Expect groups
Sim 310.1435      a
Nao 280.9968      a
```

```
$means
      Expect     rank      std   r Min Max Q25 Q50 Q75
Nao 3.093434 282.3283 1.104127 396   1   5   2   3   4
Sim 3.187500 295.8864 1.081830 176   1   5   2   3   4

$groups
      Expect groups
Sim 295.8864      a
Nao 282.3283      a
```

```
$means
              Expect     rank      std   r Min Max  Q25 Q50 Q75
1 a 3 vezes 3.119186 286.8314 1.088119 344   1   5 2.00   3   4
Diariamente 3.270833 307.6146 1.080732  96   1   5 2.75   3   4
Nunca       3.022727 270.2803 1.128844 132   1   5 2.00   3   4

$groups
              Expect groups
Diariamente 307.6146      a
1 a 3 vezes 286.8314      a
Nunca       270.2803      a
```

```
$means
     Expect     rank      std   r Min Max Q25 Q50 Q75
A  3.087156 281.8062 1.106603 436   1   5   2   3   4
NA 3.235294 301.5478 1.062738 136   1   5   3   3   4

$groups
     Expect groups
NA 301.5478      a
A  281.8062      a
```

```
$means
     Expect     rank       std   r Min Max Q25 Q50 Q75
NT 3.039773 273.5824 0.9992042 176   1   5   2   3   4
ST 3.091463 281.9146 1.2225590 164   1   5   2   3   4
T  3.206897 299.5409 1.0732258 232   1   5   2   3   4

$groups
     Expect groups
T  299.5409      a
ST 281.9146      a
NT 273.5824      a
```

```
$means
              Expect     rank       std   r Min Max Q25 Q50 Q75
NaoTreinado 3.056818 277.0284 1.1249698 440   1   5   2   3   4
Treinado    3.340909 318.0720 0.9715773 132   1   5   3   3   4

$groups
              Expect groups
Treinado    318.0720      a
NaoTreinado 277.0284      b
```

```
$means
    Expect     rank       std   r Min Max Q25 Q50 Q75
1 2.675325 220.2370 1.1078043 154   1   5   2   3   3
2 2.960630 262.6693 1.1155579 127   1   5   2   3   4
3 3.288889 310.0556 0.9609282 135   1   5   3   3   4
4 3.366667 323.6625 0.9608586 120   1   5   3   3   4
5 4.166667 441.8194 0.8451543  36   1   5   4   4   5

$groups
    Expect groups
5 441.8194      a
4 323.6625      b
3 310.0556      b
2 262.6693      c
1 220.2370      d
```

3h. Segmentation (Impression in Relation to Odour) Results

```
$means
   Impress     rank      std   r Min Max Q25 Q50 Q75
A 3.246914 321.1944 1.104798 324   1   5   3   3   4
B 2.709677 241.1734 1.066791 248   0   5   2   3   3


$groups
   Impress groups
A 321.1944      a
B 241.1734      b


$means
             Impress     rank      std   r Min Max Q25 Q50 Q75
Interessado 3.056338 293.5722 1.132711 284   0   5   2   3   4
Novato      2.972222 279.5260 1.107116 288   1   5   2   3   4

$groups
             Impress groups
Interessado 293.5722      a
Novato      279.5260      a


$means
                 Impress     rank      std   r Min Max Q25 Q50 Q75
Hypersensitive 3.107143 298.8750 1.090815 140   1   5   2   3   4
ND             2.735294 245.6324 1.149784 136   0   5   2   3   4
Sensitive      3.121094 302.9961 1.097673 256   1   5   2   3   4
Tolerant       2.950000 276.5625 1.131144  40   1   5   2   3   4

$groups
                 Impress groups
Sensitive      302.9961      a
Hypersensitive 298.8750      a
Tolerant       276.5625     ab
ND             245.6324      b


$means
    Impress     rank      std   r Min Max Q25 Q50 Q75
W1 3.342657 334.7622 1.113963 143   0   5   3   4   4
W2 2.888112 268.1958 1.028502 143   1   5   2   3   4
W3 2.657343 234.5909 1.094834 143   1   5   2   3   3
W4 3.167832 308.4510 1.125792 143   1   5   2   3   4

$groups
    Impress groups
W1 334.7622      a
W4 308.4510      a
W2 268.1958      b
```

```
W3 234.5909      b
```

```
$means
   Impress     rank      std   r Min Max Q25 Q50 Q75
F 2.978571 282.6679 1.129391 280   0   5   2   3   4
M 3.047945 290.1747 1.111219 292   1   5   2   3   4

$groups
   Impress groups
M 290.1747      a
F 282.6679      a
```

```
$means
     Impress     rank      std   r Min Max Q25 Q50 Q75
Nao 3.032847 289.1761 1.116118 548   0   5   2   3   4
Sim 2.583333 225.3958 1.138904  24   1   5   2   3   3

$groups
     Impress groups
Nao 289.1761      a
Sim 225.3958      a
```

```
$means
     Impress     rank      std   r Min Max Q25 Q50 Q75
Nao 3.017241 287.1024 1.103560 464   0   5   2   3   4
Sim 3.000000 283.9120 1.191873 108   1   5   2   3   4

$groups
     Impress groups
Nao 287.1024      a
Sim 283.9120      a
```

```
$means
     Impress     rank      std   r Min Max Q25 Q50 Q75
Nao 3.015152 286.3093 1.109121 396   1   5   2   3   4
Sim 3.011364 286.9290 1.146366 176   0   5   2   3   4

$groups
     Impress groups
Sim 286.9290      a
Nao 286.3093      a
```

```
$means
             Impress     rank      std   r Min Max Q25 Q50 Q75
1 a 3 vezes 3.081395 296.9491 1.127086 344   1   5   2   3   4
Diariamente 3.020833 285.6302 1.005031  96   0   5   2   3   4
Nunca       2.833333 259.9015 1.166758 132   1   5   2   3   4

$groups
             Impress groups
1 a 3 vezes 296.9491      a
Diariamente 285.6302     ab
Nunca       259.9015      b
```

```
$means
    Impress     rank      std   r Min Max Q25 Q50 Q75
A  3.002294 284.6147 1.123416 436   1   5   2   3   4
NA 3.051471 292.5441 1.111021 136   0   5   2   3   4

$groups
    Impress groups
NA 292.5441      a
A  284.6147      a
```

```
$means
    Impress     rank      std   r Min Max Q25 Q50 Q75
NT 2.909091 275.3381 1.186942 176   0   5   2   3   4
ST 3.000000 283.1738 1.187873 164   1   5   2   3   4
T  3.103448 297.3190 1.009730 232   1   5   2   3   4

$groups
    Impress groups
T  297.3190      a
ST 283.1738      a
NT 275.3381      a
```

```
$means
             Impress     rank      std   r Min Max Q25 Q50 Q75
NaoTreinado 2.979545 280.6727 1.132272 440   0   5   2   3   4
Treinado    3.128788 305.9242 1.072952 132   1   5   3   3   4

$groups
             Impress groups
Treinado    305.9242      a
NaoTreinado 280.6727      a
```

```
$means
   Impress     rank       std   r Min Max Q25 Q50 Q75
1 2.435065 204.5779 1.1256099 154   1   5   2   2 3.0
2 2.763780 248.6339 1.0499939 127   1   5   2   3 3.5
3 3.192593 311.0630 0.9811378 135   1   5   3   3 4.0
4 3.533333 361.9458 0.9342532 120   0   5   3   4 4.0
5 3.972222 426.9306 0.7740842  36   2   5   4   4 4.0

$groups
   Impress groups
5 426.9306      a
4 361.9458      b
3 311.0630      c
2 248.6339      d
1 204.5779      e
```

3i.Mean Global Evaluations between Wines and Categories

Category	Class	W1	W2	W3	W4
Age	<35 years	3.36[a]	2.95[a]	3.31[a]	3.31[a]
	>=35 years	3.28[a]	2.82[a]	3.26[a]	3.26[a]
Sex	F	3.32[a]	2.84[a]	3.24[a]	3.24[a]
	M	3.33[a]	2.93[a]	3.34[a]	3.34[a]
Food Allergies	Y	3.46[a]	3.14[a]	3.44[a]	3.44[a]
	N	3.30[a]	2.84[a]	3.25[a]	3.25[a]
Frequency	Nv	3.47[a]	2.79[a]	3.31[a]	3.31[a]
	1-3	3.33[a]	2.92[a]	3.23[a]	3.23[a]
	D	3.17[a]	2.95[a]	3.52[a]	3.52[a]
Training	NTr	3.24[a]	2.76[b]	3.35[a]	3.35[a]
	Tr	3.64[a]	3.30[a]	3.09[a]	3.09[a]
Knowledge	Beg	3.27[a]	2.79[a]	3.24[a]	3.24[a]
	Int	3.40[a]	3.08[a]	3.37[a]	3.37[a]
PROP	NT	3.26[a]	2.89[a]	3.23[a]	3.23[a]
	T	3.29[a]	2.91[a]	3.38[a]	3.38[a]
	ST	3.45[a]	2.85[a]	3.26[a]	3.26[a]
Vinotype	Hs	3.66[a]	2.94[ab]	3.25[a]	3.25[a]
	Se	3.27[a]	3.20[a]	3.42[a]	3.42[a]
	Tol	3.10[a]	2.60[ab]	3.30[a]	3.30[a]
	Unk	3.24[a]	2.32[b]	3.15[a]	3.15[a]