



Report on Beginning Coffee Cupper Training for Asociacion de Café Especialdad de Bolivia

Program Held October 5-8, 2005
Report Submitted October 18, 2005
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Executive Summary

A four-day beginning cuppers training program sponsored by the Asociacion de Café Especialdad de Bolivia and financed by USAID through the ARCo project was held in La Paz, Bolivia October 5-8, 2005. The purpose of the program was to introduce the concepts and methods of the process of sensorial analysis of coffee known within the industry as “cupping,” and then use information gathered to design a program involving further training and practice.

Few participants had cupped previous to this program, which included those involved in the coffee industry and other interested individuals. The fundamental concepts discussed in lecture and demonstrated by cupping coffee samples included individual and combined flavor attributes, defects and off flavors, how samples are affected by levels of roast, and methods of testing. A test was held at the conclusion of the program in which 5 samples were submitted to panelists about which they were questioned.

About 90% of the panelists recognized the defective sample, over 60% recognized the sweetest samples, and 71% selected the highest quality samples as having the best balance of overall flavor qualities (it is typically more difficult to recognize and discriminate between levels of positive flavor attributes than to recognize defects). Some confusion about quality of acidity was revealed, but this is often the case with beginning cuppers and can be overcome through continued practice. A wide diversity of aromatic qualities was recognized in various samples. It was concluded that the goals of the training had been accomplished by the majority of participants.

Programs of progressive training (p. 13-14, with suggested timeline of specific programs on p. 19), practice sessions (p. 14-15, with suggested timeline on p. 18-19), and a process of certification (p. 15-16) based on these results are suggested.

October 18, 2005

Report on Coffee Cupper Training for Asociacion de Café Especialidad de Bolivia

Purpose of Training and Report: The training was held to demonstrate to participants the method of sensory analysis common in the coffee industry as a method of evaluating coffee quality using Bolivian coffees and coffees from other origins to illustrate various flavor traits. This report is issued to assess the program, review participant responses, and suggest next steps, including a complete cupper training program and design of a certification process for the Bolivian 2006 Cup of Excellence event.

Background: The training was held in La Paz, Bolivia from October 5 to October 8, 2005 with a total of 28 participants completing the program and turning in the final test. The training covered theory of sensory analysis and coffee flavor attributes, practical application in the form of cupping, sensory exercises regarding specific flavor attributes, and coffee cupping exercises. A summary of the program outline is given in Appendix I. Handouts prepared for each day are given in Appendix II. A test was given at the end of the training consisting of 6 samples. Participants were requested to cup the coffees, fill out the forms, and then use their notes to answer specific questions about the samples.

The primary job of a coffee cupper is to ensure that no flavor defects are present. Once this is determined, they must classify the sample according to its flavor attributes to determine for which market it is most suitable. The specialty market commands the highest premiums, but not all samples are on the specialty level. A cupper's function within a coffee business is to objectively evaluate each sample to both maximize value of what is available and maintain the reputation of the origin or business. If too many mediocre samples are passed as "specialty," the reputation of the origin suffers. On the other hand, if samples with specialty potential are graded lower or if the specialty sample is mixed in with other samples of lesser quality, its value has not been optimized.

To effectively perform this function, the cupper must have some basic training in testing methodology, knowledge of flavor attribute terminology and how it is commonly used, and an overall view of the purposes of coffee tasting. The skills developed include greater sensitivity to sensory phenomena, the ability to consistently classify one's sensory experience in terms of quality and intensity, "taste memory" (a mental database of recalled flavor experiences), and the ability to apply those skills. The approach taken for this course is market oriented in that the goal of cupping is ultimately to meet the needs of consumers, regardless of one's personal preferences.

Since this training was for beginning cuppers, test methodology and flavor experience classification and communication was emphasized. A way of relating to the sensory experience was suggested and reviewed every day:

1. Check the sample for off flavors or defects.
2. Evaluate the individual flavor attributes according to how they are experienced in terms of quality (type) and intensity.

3. Evaluate how the individual flavor attributes combine in various ways to create overall impressions (this is the way a consumer tends to experience the coffee).

One begins to cup by recognizing the flavor experience and classifying it according to its quality and intensity, and then communicating that experience according to the purposes of the test. Some qualities are more important and easily learned than others. Aromatics, for example, can be highly subjective, despite their importance in the coffee experience. Sweetness and acidity are important indicators of quality, but the novice cupper often confuses various sensory experiences related to acidity, such as astringency and outright sourness. Judgments regarding combinatory flavor attributes are often difficult for the beginner, but they should begin to work with that aspect.

Results of training:

According to information gathered the first day (informally, through the raising of hands and discussion), more than 75% of the class had not formally cupped coffee previously. However, most participants were involved in coffee in one way or another; there were growers, mill workers, exporters, and one geneticist/agronomist from Brazil. At least one attended with no professional aspirations, just a strong interest in coffee.

The participants responded enthusiastically to the material presented, with most readily sharing in the discussion. Given the personal nature of sensory perception, individuals are often inhibited in describing their experiences in a group situation. Fortunately, participants were willing to share their experiences and were mutually supportive and polite towards others even in disagreement.

Many participants also asked questions particular to their interest, either within the group or individually to the presenter. A high level of interest was evident, with most participants engaged a paying attention throughout the seminar. Group dynamics play a large part in the success of any training program and the commitment, interest, and level participation of this particular gathering was notable and contributed to the success of the program.

The final test was given to evaluate if participants had understood the most important aspects of the material. Participants were requested to cup the coffee following standard procedures using a familiar and appropriately detailed form (the Cup of Excellence form) and encouraged to write additional notes on the samples. They were told that the actual test would be to answer questions based upon their notes and perceptions.

As seen in the outline, a progression-of-roast cupping (a single sample roasted to 4 different levels) was presented to familiarize participants with the way that a roast can affect flavor and with how the consumer often sees the product. Aspects of roast degree were not tested for, but some panelists did include roast remarks in making their selection.

Analysis of Test Results

Samples for the test were chosen to illustrate particularly important aspects of quality and intensity of flavor attributes. A total of 2 specialty samples, 2 average to good quality samples, and 1 defective sample was chosen. Since this was a beginning class, the samples selected were particularly distinctive in some respects. The samples selected are listed in Table 1 in the order presented, along with the attributes they illustrated.

| Sample | Illustrated quality |
|---------------|--|
| 1 | <i>Average</i> but without flavor defects or taints, clean, some sweetness, moderate acidity, not much aroma or notable flavor qualities |
| 2 | <i>Specialty</i> , sweet and balanced, clean, medium acidity, medium/heavy body, highly aromatic with floral, fruit, walnut/hazelnut, and chocolate aromas |
| 3 | <i>Average</i> , without defects or taints, but not completely clean, some astringency, little body, and a poor finish |
| 4 | <i>Defective</i> (mold and ferment on all tables), but not of overpowering intensity |
| 5 | <i>Specialty</i> , sweet and balanced, clean, high in acidity, medium body, highly aromatic with predominant fruit aromas, chocolate, and caramel |

The questions submitted to panelists were:

1. Were any samples defective or contaminated?
2. Which was the sweetest coffee?
3. Which was the most balanced coffee?
4. Which was the coffee with the highest quality acidity? Why?
5. Which was the coffee with the most complex aroma? Describe its qualities.

Results from the test are discussed below in terms of what the questions revealed about participants' abilities.

Recognition of defective coffees: The basis of quality of any food or beverage is the absence of defects or off-flavors. This is difficult to test on a table where other points are being illustrated, since defective coffees tend to stand out. The defective sample chosen was not overpowering in such a way as to affect other perceptions, but consistently demonstrated off flavors. A summary of panelist results can be seen in Figure 1.

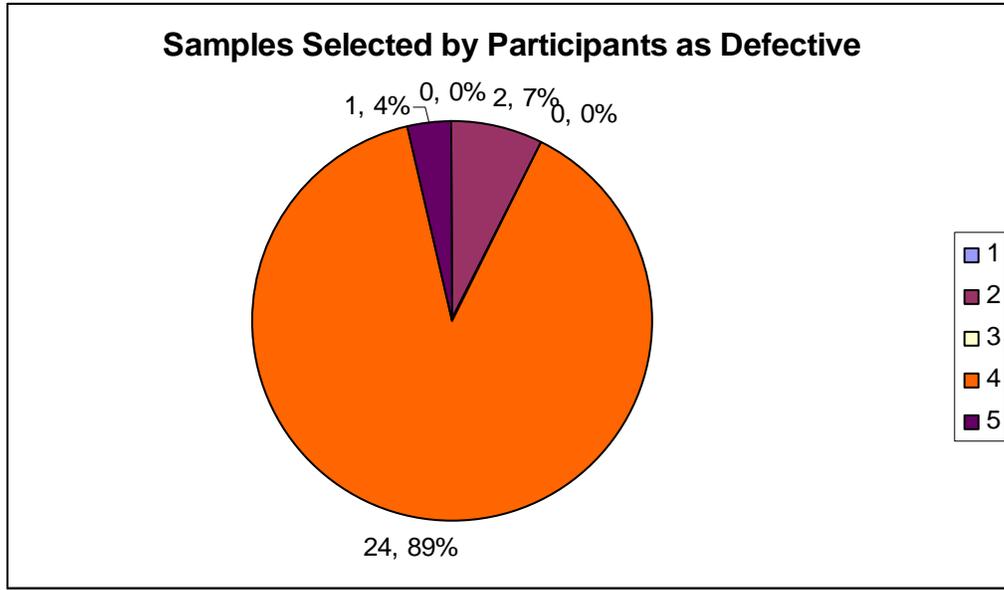


Figure 1: The orange indicates the correct answer. The first number indicates the count of participants, the second the percentage of the group.

The vast majority of participants picked up on the defective sample. Two of the three participants that did not recognize sample 4 as defective chose instead at least 2 other samples. This demonstrates a lack of recognition, but could also indicate a potential psychological error possibly due to the stress of a test.

Recognition of sweetness: Sweetness is an important indicator of quality coffee, especially in the specialty market. However, what cuppers refer to as “sweetness” is not as obvious in a coffee sample as in beverages containing significant amounts of added sucrose. Two notably sweet coffees were present on the table and either sample 2 or sample 5 was accepted as a correct answer. Sample 1 also had some sweetness, but did not have as much intensity of sweetness as 2 or 5. Sample 3 should not have been chosen; besides having a low level of sweetness, it had some astringency. The following table summarizes results.

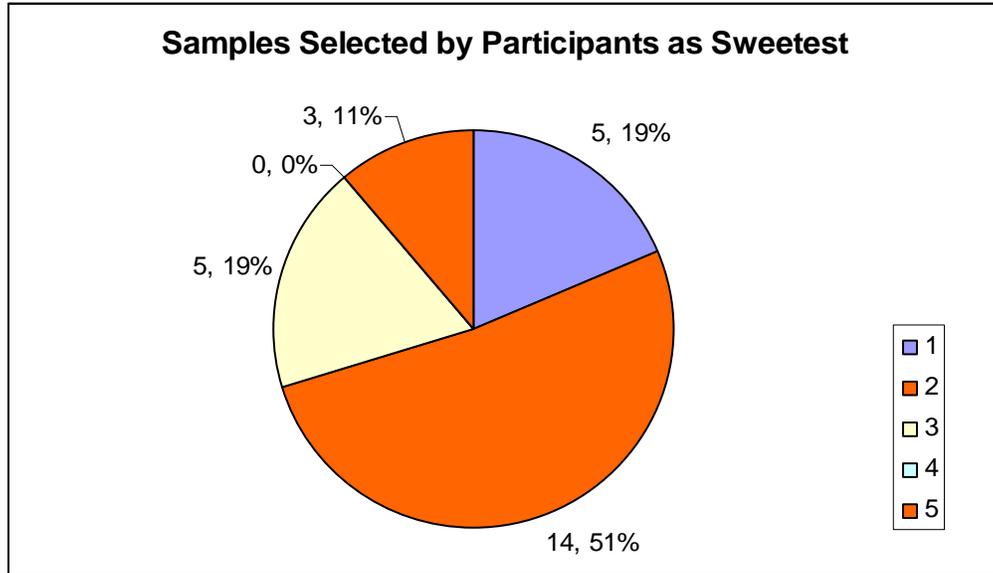


Figure 2: The orange areas indicate samples accepted as correct answers. The first number indicates the number of panelists, the last the percentage of the group. Over 51% of the group chose sample 2.

Over 60% of participants selected the intended samples and none selected the defective sample. Sample 1 did have some sweet qualities to it, including aromatics, and it may be expected that less experienced cuppers would choose that sample. Of more concern is the 20% that chose sample 3, which had some astringency and a poor short finish that should have indicated a lack of sweetness.

Sample 5 was arguably as sweet as or sweeter than sample 2 (according to the senior cuppers who chose the samples), but only 11% chose that sample. This could be due to the more acidic nature of sample 5 rendering the sweetness of the sample less obvious.

Balance: This requires a judgment based upon the participants' ability to take into account all flavor aspects of a coffee and there was no specific right answer, though sample 2 had been selected on the basis of its balance of sweetness, acidity, aromatics, and body. The goal of the question was to see how panelists were able to take into account all flavor attributes.

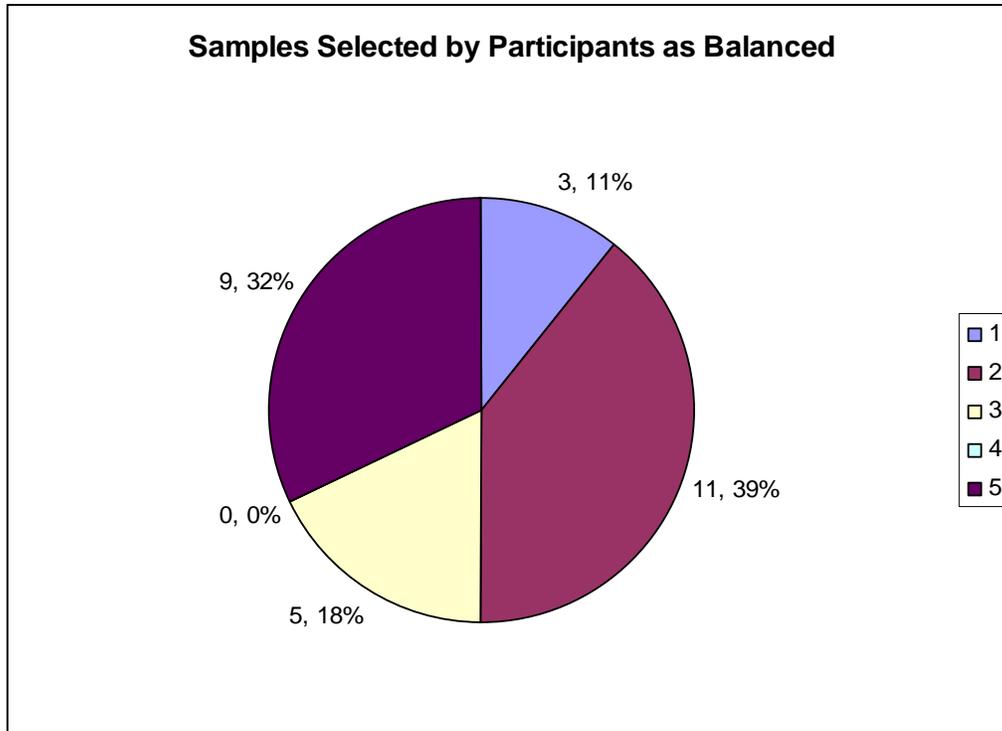


Figure 3: There was no absolutely right answer for this question, though sample #2 had been selected for this purpose.

The majority of panelists (71%) selected the sweetest samples as being the most balanced, indicating that they did recognize the importance of this attribute in the overall evaluation. Many participants that had selected sample #2 as sweetest selected sample #5 as most balanced, citing its aromatics (especially fruit), acidity, and sweetness.

Those that selected sample #1 as most balanced did not give written reasons, but senior cuppers noted this sample was reasonably clean and did not have any defects, just a lack of flavor intensity and it did have some sweetness. These panelists could have interpreted balance to be this lack of intensity, with no single attribute dominating another resulting in a mild but pleasant coffee.

For those that selected sample #3, one of the panelists had not found the defective sample in the first question (selecting sample 5) and made other significant mistakes indicating that they did not understand the seminar. Two had selected sample #3 as being sweetest in the previous question, indicating that they did not pick up on the astringency of 3 or the comparative sweetness of 2 and 5. Another had selected sample #1 as sweetest. All of these need further experience with the issue of sweetness and astringency.

Acidity: Acidity is the primary gustation aspect of coffee and a great deal of emphasis was put on the quality of acidity and how it is modified by the other gustation aspects (especially sweetness and the potassium salt response described by coffee tasters as “roughness”). Since many Bolivian coffees are grown at high altitudes, it is especially important for Bolivian cuppers to discern between high quality acidity, lesser quality, astringency, and the sourness caused by poor

processing. In the class, this was done by presenting solutions of acidity of various types. Citric acid, the dominant organic fruit acid in coffee, is experienced as fundamental sourness. Other fruit acids, such as malic acid (the dominant acid in apples) and tartaric acid (the dominant acidity in grapes), though present in small amounts, give interest and variety to dominant citric acid. These other fruit acids tend to occur at high altitudes and the author has noted specific qualities of tartaric acid in some of Bolivia's finer coffees (many wine terms were used by international jurors to describe the highest rated samples in last year's Cup of Excellence).

Sample #5 was selected especially for its fruit acidity matched with sweetness, cleanliness, and fruit-like aromatics. The question was formulated in Spanish (in collaboration with the translator) so that it would be clear that the highest quality ("mejor") acidity was sought, not necessarily the most intense acidity, and this was reinforced when the question was given to panelists. Results are shown in Figure 4.

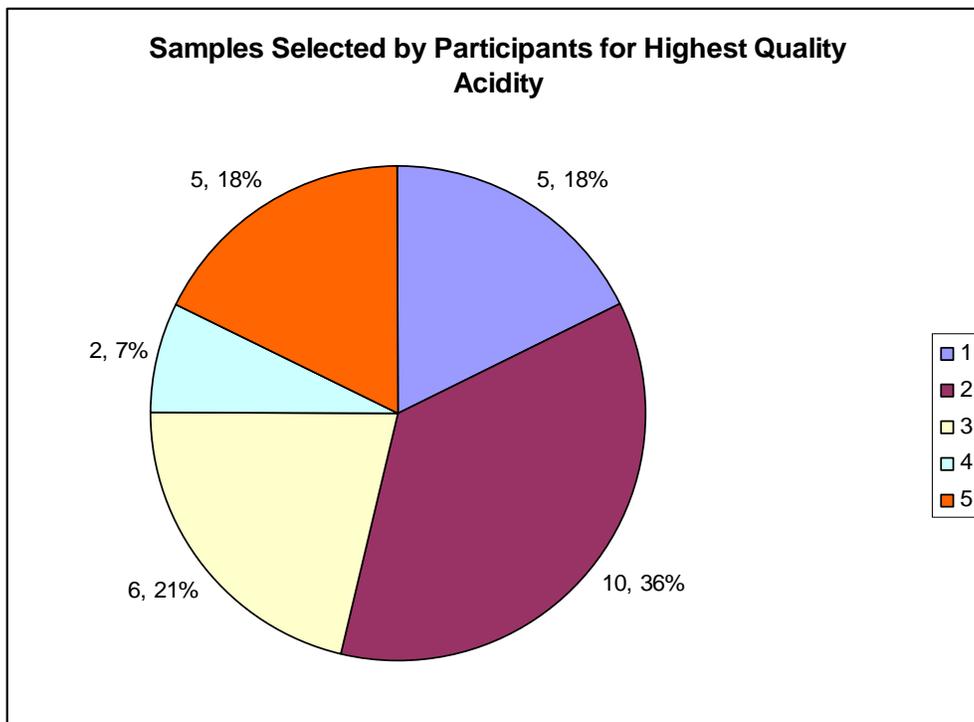


Figure 4: The orange segment shows the sample chosen as having a combination of the highest quality of fruit acids and the most intense fruit acids.

It is arguable that Sample #2 did have high quality acidity, though it was not of the intensity of Sample #5. It is possible that participants felt that the most intense acidity was necessarily of less quality, since the issue of intensity versus quality had been discussed at length during the cupping sessions. This is a typical "logical error," where a cupper tries to figure out how to respond on the basis of preconceived ideas rather than what they are actually experiencing. Many of these cited the "sweet acidity" and had selected #2 as being most sweet and/or balanced (four had chosen sample #2 in all these categories), indicating that they had possibly developed a bias towards this sample.

The 2 participants that selected defective sample #4 cited its darker roast as evidence of potential greater acidity, despite both participants having previously selected the sample as defective. This is again a logical error. By definition, a defective coffee does not have high quality acidity.

The 6 participants who selected sample # 3 made a common mistake of beginning cuppers. Coffees that are slightly immature are high in chlorogenic acid, which during roasting sublimes into astringent phenols, caffeic, and quinic acid. The latter is experienced as sour/bitter and not of high quality, but it does have intensity. If the cupper relies on intensity of flavor to determine quality, there is a chance that an astringent sample will be selected as having good acidity.

Those who selected sample # 1 did so for various reasons. Two of the five had previously selected #1 as being sweetest and another two had selected #1 as being most balanced. One of these cited #1 as having the cleanest acidity, arguable since the sample was well processed, and another stated that the “tone of the acid was intermediate” with both citric and fruit acid present. The latter shows careful consideration based on actual perception and would have to be considered a “correct” answer; these are the sorts of discussion often occurring around cupping tables. As previously noted sample #1 did have some good qualities but would have been classified as a “mild” coffee, basically sound but falling short of the usual expectations of the specialty market. It is possible that these beginners were making what they perceived to be a safe choice, a sample without the intensity of 3 or 5, the complexity of 2, or defective aspects as in 4.

Of those selecting sample #5, two recognized the clean aftertaste that is the sign of good acidity, two cited the balance of fruit qualities, and another stated that the acidity was “notable and present, but not aggressive or too intense.”

These responses demonstrate the complexity of perception of acidity in coffee. As an important part of a cupper’s education, this aspect is to be emphasized in further training and practice sessions.

Aromatics: Coffee aromatics are perhaps the most appreciated aspect of the beverage, but are the most diverse and hardest to reliably analyze. Since most aromatics are formed during roasting through sugar browning reactions, slight changes in roast parameters can have a large effect on the aromatic profile of a coffee. During analysis, the cupper must ensure that the aromatic chemicals contact the olfactory lobe and that close attention is paid to the multitude of sensations that result. Due to the ethereal nature of aromatics, psychological factors can play a part in what is perceived.

The exercise given to participants consisted of bottled aromas (“Le Nez du Café”) commonly found in various coffees. Participants were instructed to acquaint themselves with the particular aroma, and then test each other by blindly submitting bottles and asking the identity of the aroma. The purpose was to familiarize participants with the potential aromatics of coffee and to begin to develop “taste memory” through blind identification of the samples. A cupping of particularly aromatic coffees was then held to reinforce these perceptions and see how some of the scents manifest within the coffee aromatic complex.

The question asked was which sample had the most complex aroma profile. Complexity had been defined late in the course as a sample that had a lot of interacting constituents. Participants were also requested to list the quality of attributes found in the chosen sample. Results can be seen Figure 5, along with participants' descriptions of the aromatics.

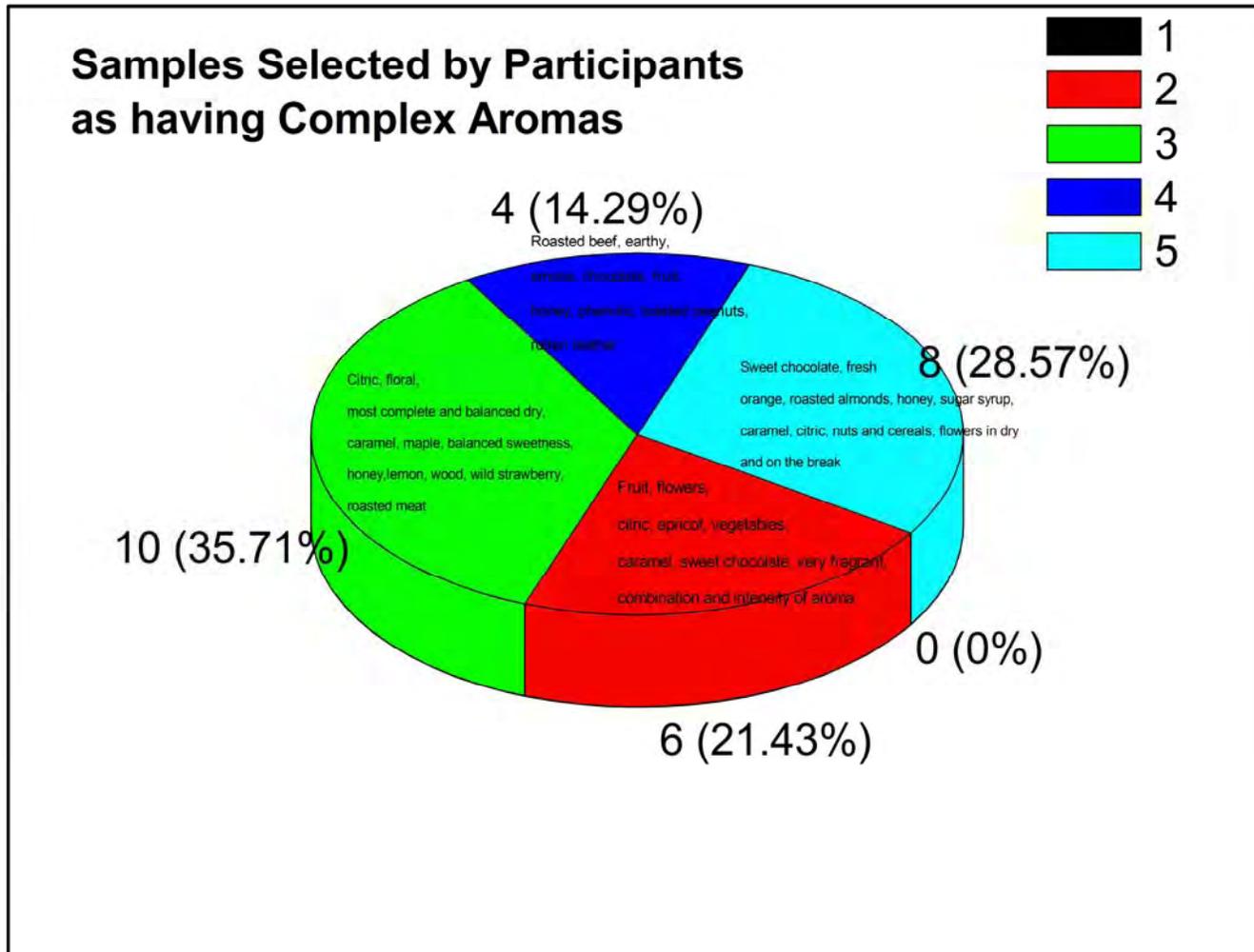


Figure 5: Selection and descriptions of aromatics by participants.

As expected, there is a diversity of findings. Most surprising are those that chose defective sample number 4, with all panelists finding some aromatics usually experienced negatively (virtually all found some sort of earth and roughness, even “rotten leather”), but still defining the sample as aromatically complex. This may be due to the formulation of the question (complexity, rather than quality, was requested). Panelists also found many more aromatic attributes in sample 3 than did those that made the original choice of samples (this sample was lightest in terms of roast, which may have had something to do with what was found). In this instance, the lack of character of sample 1 was demonstrated, with no panelists selecting it in terms of aromatic complexity.

The samples selected that were intended to represent the highest quality (samples 2 and 5) did fairly well, selected as most complex by 50% of participants. These samples had aromatics that were more subtle, including fruits, flowers, and various kinds of sugar-browning sweetness. These participants were perhaps sensitized to more subtle expressions of coffee aroma, as intended by the aroma exercises. This is a complex area, requiring ongoing practice and experience to master, and will be a part of the practice and training program.

Summary of Training Results

The enthusiastic participation and response created ideal conditions for learning. The test demonstrates that for most participants the basic ideas and experiences presented were understood, with some additional practice desirable.

1. *Recognition of defective samples:* The vast majority of panelists (89%) recognized the defective sample. Those that did not require review of the aspects causing poor flavor, especially those relating to mold. It is too common in growing countries to ignore defects and give samples the benefit of the doubt. The participants that did not perceive the defective sample also made significant other mistakes in perception.
2. *Evaluation of individual flavor attributes:* In terms of gustation, most panelists recognized the sweetest coffees, but some failed to recognize the astringent coffee (sample #3). A few chose astringent sample 3 as sweetest (perhaps due to the caramel and other sugar browning aromatics noted), while a significant amount of participants chose sample #3 as having the highest quality acidity. Given the importance of acidity in the typical flavor profile of Bolivian specialty coffee, this should be an area of concentration. Aromatics are complex and the subject of much discussion and research, but are an important aspect of coffee quality. The presentation and test showed that most panelists developed a greater sensitivity to and ability to describe aromatics; though they did not always agree on relative quality, they were able to apply appropriate descriptions. This can be developed through further practice and experience. Tactile aspects of coffee were introduced but not emphasized in this introductory course; however, mouth feel aspects are an important part of determining the overall impact of a sample and are especially important in espresso (many of the participants expressed a high interest in espresso) and should be a part of the ongoing training program.
3. *Evaluation of flavor attribute combination:* A high percentage of panelists (71%) chose the specialty samples as having the best balance, demonstrating recognition of overall quality. Another 11% chose a sample that was arguably sound and balanced from a structural point of view (reasonably good acidity, sweetness, and body, but with little

aromatic qualities or unique flavors). No participant chose the defective sample as balanced, but 18% chose the lower quality average sample, apparently ignoring the astringency and poor finish. The latter sample did have some good aromatics, which, since they are evaluated first in the cupping process, can cause some bias towards the sample. This psychological error is only overcome through experience.

From these results, it is reasonable to state that at least 90% of participants were introduced to the experience of cupping and achieved the fundamental goals of the program, with many requiring further experience and practice. The direction and progression of that experience and practice is outlined in the following section.

Cupper Training Program and Certification

The training of a coffee cupper can be seen as a continual path in which one develops sensitivity, ability to objectively express what is found through perception, abilities of drawing reasonable conclusions based on those perceptions, and building of a “taste memory,” a mental database of coffee flavor experiences.

A cupper’s training must be a progressive program of realization based upon factual study and direct experience. Knowledge alone is not enough; a good cupper must constantly train his or her sensory system. At the same time, a good factual basis is necessary so the cupper is able to put their experience in context and make reasonable conclusions based upon their perceptions.

The program suggested is one in which concepts are first introduced and demonstrated, and then immediately practiced by the cupper. Ideally, one practices by cupping day-to-day, but this is not often done in a growing country where new coffee is available only seasonally. With the market based approach taken by Songer and Associates, Inc., it is also necessary to provide cuppers with solid indications of what flavor attributes are desired by those who purchase the coffee. A period of time when new-crop coffee is not available can be used not only for further training but for exploration of flavor qualities of samples, both from other origins and from Bolivia (identifying particularly desirable flavors through descriptive cupping analysis¹ and the source of those flavors).

The level of interest of the participants has been remarked upon. To build upon this interest, a program consisting of introducing gradually more subtle sensory concepts and experiences in formal training, regular practice, and education regarding the world coffee market, including cupping with potential customers. A certification process is also suggested so that those who have undergone a certain level of training and developed a certain level of skill are recognized and appropriately utilized within the Bolivian coffee industry.

Formal Training

The goal of formal sensory training is to provide an appropriate intellectual context for and practical demonstration of particular sensory experiences. Starting from the most basic and obvious aspects, clear differences are drawn (though with a natural product like coffee clear

¹ An outline of this more advanced cupping method, goals, and applications can be found in Appendix III.

differentiation can be difficult) through direct comparison. Gradually through practice, the cupper becomes more sensitive, mentally organized, and confident in his/her abilities, and can make more subtle distinctions and judgments. Formal training must be challenging enough to keep cupper interest and encourage development of abilities, while not being too difficult to master, which runs the risk of de-motivating the cupper.

Specific step-by-step topics of training include:

Beginning:

1. Recognition of flavor attributes, their classification, and the origin of their perception from physical and psychological points of view.
2. Methods of testing, necessity of following set procedures in order to obtain consistent and replicable results
3. Ability to objectively express what is perceived according to what information is needed about the sample in terms of classification of quality and scales of intensity.
4. Recognition of what are generally regarded as flavor defects.
5. Introduction to a larger view of the sensory experience that puts perception of individual attributes into the context of the whole flavor experience.

Intermediate:

1. More subtle recognition of flavor attributes, calling upon the cupper's developing taste memory to recall specific aromas, qualities of acidity, and combinations of gustatory sensations.
2. Knowledge of origin of flavor attributes from a production viewpoint (altitude, agricultural factors, processing parameters, etc.) and how these manifest in the cup.
3. Different testing procedures and applications of developed skills to those tests (triangle difference testing, 1 of 2 testing, signal perception, etc.).
4. Beginning market knowledge: how much of what quality of coffee is sold to who and why it is sold (from a sensory point of view). This should include cupping with international buyers and attuning to their responses and preferences.
5. Development of knowledge of specific coffee issues and market segments (perhaps based upon individuals' interests) such as the American specialty market, espresso, aspects of roasting, etc.
6. Introduction to descriptive analysis, detailing the actual flavor attributes and their intensity in more detail

Advanced:

1. Training other cuppers, mentoring them through the process. This would require sessions on training and presentation.
2. Product development for coffees aimed at specific markets through descriptive analysis, including what flavor attributes and intensities are required, where one is most likely to find these coffees, and ideal processing parameters. This necessarily requires integration with sales and marketing interests.
3. Design of quality control programs including physical tests and cupping that will maintain a level of quality and the flavor attributes appropriate for the product.

4. Further involvement in the international market so that potential customers' desires can be determined and opportunities explored. This should include attendance at various conferences.
5. Presentation of Bolivian coffee in national and international settings designed to build the reputation of the Bolivian coffee industry.

Practice Sessions

To continue to build interest of Bolivian cuppers, regular practice sessions can be held in which previously presented concepts are reviewed and reinforced through sensory exercises. These can include exercises for beginning, intermediate, and advanced cuppers.

Beginning:

1. The basic exercise on aromatics given in the introductory session. Participants should be encouraged to bring their own samples exhibiting particular aromas. These should be coded with anonymous 3-digit codes and submitted to panelists following the use of the bottled aromas.
2. The basic exercise on recognition of gustation attributes given in the introductory session. This includes basic types of acidity (fundamental citric acid, other fruit acids, aromatic acids, quinic based acids, and inorganic phosphoric acid) and modifying sweet, "rough," and bitter attributes. As shown in the test, an emphasis should be placed on the quinic acid versus the sweet more fruit-like aspects. According to this system, some acids are not introduced until the intermediate level, since they involve more complex flavor interactions, but the basic citric acid, other fruit acids, and their modifiers can be initially done.
3. Direct comparison cupping of small numbers of samples selected by senior cuppers. These should be small tables of not more than 4 samples that clearly illustrate a single point, such as quality of acidity, sweetness, specific aromatics, or mouth feel. For beginners to benefit, samples selected must be quite different and clearly illustrate the intended point.

Intermediate:

1. Expansion of basic aromatic exercises into other areas that may include other aromatics (flowers, fruits, or other aroma sets), wines, or beer. (It is not necessary to drink the wine or beer to examine the aromatics, but it is probably inevitable in such an exercise.)
2. More complex combinations of acidity and gustation modifiers.
3. Different sensory tests, such as those designed to test for difference or similarity (triangle or 2-of-5 tests) and comparative testing (1 of 2 or sample to standard testing). These require the cupper to use their skills but think about them in a different way.
4. Descriptive cupping practice: getting into the details of coffee flavor step by step, working in small groups, and descriptive cupping training.
5. Development of a wider view of the world coffee market by cupping typical samples and studying market trends and current preferences.

Advanced:

1. Product development: determining how the best Bolivian coffees would fit into the current specialty markets in North America, Europe, and Japan based on available flavor attributes to appeal to preferences within those markets. Cuppers would use descriptive techniques to focus upon the necessary agricultural, regional, and processing parameters that would result in such a product. The sessions would be led by advanced cuppers, but intermediate cuppers could also participate.
2. A successful program initiated by the Asociacion de Café Especialdad de Nicaragua holds regular cupper meetings in which senior cuppers give talks and illustrations on the cupping table of the topic. This requires the advanced cupper to perform research and develop skills of presentation.

Certification Process

A good certification process serves to motivate aspiring cuppers and helps the industry determine internal available skills if it is fairly administered and consistently tests actual knowledge and skills. Some certification, such as that used by the New York Board of Trade, is oriented towards grading and finding defects, while others, such as tests employed by the Coffee Quality Institute, can be quite elaborate. The certification process suggested here corresponds to the training levels listed above and contains written (knowledge) and sensory aspects.

ACEB Certified Cupper:

The goal of the test for the beginner is to encourage them while ensuring that they are equipped with the basic skills and concepts necessary for cupping. The sensory test would be similar to the one described for the program, a limited number of samples with obvious differences. The proctor for the test should test each submitted sample to ensure that it represents the intended quality. The written section would include the same types of questions as given participants and have a multiple choice section in which knowledge of basic sensory concepts and test methodology are tested. Upon passing this test, the participant would become an ACEB certified cupper (Catador Certificado de ACEB).

For the previously conducted seminar based on test results, all but 5 participants would have passed (with the written test yet to be determined). The 5 participants showed confusion regarding defects, quality of acidity, and sweetness, most of which could be remedied through practice.

Advanced Cupper:

This test would include a sensory section using known aromatics and solutions, a written section, and a second sensory session using coffee and cupping in the traditional manner.

1. For the known aromatics, samples of the Le Nez du Café set would be blindly submitted. Aspirants would classify those aromas as nuts, fruits, flowers, sugar browning, etc. and get additional points if they can identify the actual aroma by name. A similar procedure would be developed for use of the various acid solutions, identifying them according to quality (acid, fruit acid, sweet, etc.).

2. The written section would include information about the world coffee market, such as number of bags consumed, relative quality, in which markets it is consumed, and similar details specific to the Bolivian coffee industry.
3. The coffee section would be similar to the current Cup of Excellence National Panel Test (Appendix VI). Several samples of known quality are submitted to panelists and they are graded on their ability to recognize the quality and intensity of those flavor attributes. Rather than selecting a certain number of panelists, a minimum score would ensure passing the test. As with the first test, a proctor (or two) must check each sample submitted to panelists to ensure that they are not defective and represent the intended qualities.
4. In addition to passing the test, it is suggested that the cupper be required to attend and participate as a cupper in an international event involving cupping with those of other countries. This could include a Cup of Excellence event held in Bolivia or other international events (SCAA, Sintercafe, other cupping events).
5. The cupper should work within some aspect of the Bolivian coffee industry for a period of 2 years. Some service aspect to the ACEB organization such as assistance with training programs could also be imposed.

Upon passing these requirements, the cupper is certified as advanced cupper (Certificado Catador Avanzado). At this point they would be enabled to test for the Cup of Excellence 2006. All current and past COE National Jury participants would qualify for this level if service requirements were met.

Master Cupper:

Master cupper candidates would demonstrate that they have maintained their skills by passing the same sensory tests as outlined for the intermediate cuppers.

1. They should be employed in the coffee industry for a period of 5 years.
2. Part of their service would be to proctor the intermediate test.
3. They should regularly participate in the selection of samples for and the giving of training programs.
4. They should complete a project approved by the director of ACEB and reviewed by other Master Cuppers that requires research and demonstration of conclusions through selected samples. The subject of these projects could be processing or agricultural parameters, studies of specific markets, or studies of specific product types (such as espresso). The project would culminate in a presentation given to cuppers during a practice session.

Completing these requirements, they would be certified as Maestro Catador. Several cuppers in Bolivia would qualify for this level.

There may be other means considered for passing requirements, such as equivalent programs given by CQI, the “Sensory Skills Test” (involving solutions of acid, sugar, and salt) given occasionally by the SCAA, the COE National Jury Test, or others. However, any sensory certification should eventually relate directly to the cupping of coffee samples in a professional situation such that the cupper would find day-to-day. The outline given here is specifically designed to address the needs of the Bolivian coffee industry at this stage in its development given the various skills of its cuppers.

The goal of this program is not only to impart the cupping skills to develop the Bolivian coffee industry, but prepare participants for other professions should they decide not to pursue coffee as a career. Following outlined procedures, objective observation, and a professional attitude that considers the customer as a primary arbiter of quality can serve in endeavors other than coffee.

Suggested Timeline for Training and Practice Sessions

Until a formal program of certification is put into place, it can reasonably be assumed that those cuppers selected for the Cup of Excellence National Jury are certified at least at the level of “Certificado Catador Avanzado” and several are capable of quickly attaining the level of “Maestro Catador” with the additional service and project requirements. Suggested training and practice is designed to meet the needs of all levels of cuppers while addressing immediate needs of the Bolivian coffee industry.

Bolivian Coffee Industry Development

Economists have observed that as a land-locked country with difficult infrastructure, Bolivia should concentrate on products that have high value per unit weight. The country has historically done so with products such as silver, gold, rubber, tin, and coca². For coffee to enter this realm, a market strategy targeted at the North American, Japan, and Europe specialty coffee markets must be put into place. This starts with developing a product that will appeal to this market and can be regularly supplied, to be accomplished by the experienced cuppers who thoroughly know the product. The second step is in building a reputation for Bolivian coffee in consuming countries. The Cup of Excellence can assist in performing both functions if information developed through the competition is properly utilized.

A major challenge in appealing to the specialty market is determining which flavor attributes are deemed specialty. The COE International Jury selects samples based upon sweetness and cleanliness, but when samples have met those requirements they are selected on the basis of preference of flavor attributes. From a technical standpoint, any coffee can attain a level of sweetness and cleanliness if it is harvested and processed properly (not an easy accomplishment, but possible). Other flavor attributes will be due to unique conditions of plant material, soil, cultivation, and climate –aspects unique to Bolivia. The most well known coffees in the world that command the highest price (Kenya, Sumatra Mandheling, and Guatemala Antigua are examples) do so because they have recognizable flavor profiles. Bolivian cuppers can potentially

² David Morawetz, as quoted in:
Sachs, Jeffrey. The End of Poverty. 2005, Penguin Press, New York, p. 104.

determine their ideal flavor profile by applying descriptive analysis to samples selected by the COE International Jury.

The marketing of an origin is beyond the scope of this report, but it should be addressed as a function of cuppers' abilities to supply the product. Flavor attributes are the primary basis for marketing a food/beverage product, but such aspects as image, consumer interaction, and other factors are involved. Opportunities to market the origin occur when COE samples are purchased. Assistance in marketing could come from ACEB or other marketing organizations in presenting an image of the country along with the coffee, with the goal to associate the flavor profile with the country's image in the consumer's mind.

As with most growing countries, there are times when cuppers in Bolivia are quite busy (during harvests) and times when they are less busy that could be devoted to training, product development activities, and marketing. A yearly schedule can be drawn up so that cuppers are employed to their maximum potential and maintain cupping skills and sensitivity.

Timeline of Practice Sessions

The intention of practice session is to focus cuppers on one aspect of the cupping experience to keep skills sharp. Suggested practice sessions are to be held monthly for half a day (or more often if possible, though during the harvest season participation is less likely). A suggested schedule of topics for the next year follows.

Practice session November: Focus on acidity: the difference between desirable fruit acidity (also referred to as "brightness" or "sparkle"), sourness (excessive aromatic acidity caused by poor processing), and astringency (excessive chlorogenic and quinic acids caused by immature fruits). Direct comparisons of coffees illustrating these points are to be brought and submitted by participants to the group. Coffees rejected due to astringency by COE International Panelists (who tend to be highly sensitive to this aspect) can be tested.

Practice session December: Gustation attributes basic exercises (balance of acidity, sweetness and roughness) could combine with COE selections (by then, auction results will be known).

Practice session January: Aromatics exercise using Le Nez du Café followed by samples submitted by participants. COE selections can be included.

Practice session February: Descriptive cupping exercise (see training schedule below). This can take either of 2 forms: (1) other COE samples are analyzed descriptively or (2) samples are selected by panelists that exhibit the same attributes or have a similar flavor profile to those already analyzed.

Practice session March: Selection of samples for the SCAA trade show that best represent the range of flavors of Bolivian coffee.

Practice session April: Review of gustation aspects, with illustrative samples selected by one of the labs, and review of common faults.

During the SCAA show, those attending should gather green and roasted samples as they are available.

Practice session May: Presentation from those attending SCAA show and cupping roasted samples, including blends, dark roasts, and blends formulated especially for espresso.

Practice session June: Cupping green coffees from the SCAA show.

Practice session July: Aromatics exercise; re-cup Bolivian samples tested earlier in the year to determine if aromatic quality or other attributes have been lost.

Practice session August: Presentation and cupping assigned to one of the labs.

Practice session September: Prepare for COE panel test.

Practice session October: COE training session.

Timeline of Training Sessions

Training sessions are to be held quarterly or more often in case of special events. An advanced training session is suggested early in the year to take advantage of coffee selections made by the Cup of Excellence as a means of determining preferred flavor attributes in various world markets.

January advanced training session (4-day): A 2-day training session on descriptive cupping, followed by 2 days of application. After cupping winning lots with senior cuppers, three samples are to be submitted to the panel (made up of the National Jurors who originally selected the samples) for detailed analysis. Once the panel is taken through this exercise, they can follow up on their own with other samples (a practice session in February is suggested).

April intermediate training session (3-day): Expansion of acidity to include quinic, chlorogenic, and non-organic acids such as phosphoric, with samples to illustrate points (this could prepare participants to take the sensory skills test at the SCAA show). Coffee quality as determined in the marketplace, with samples of roasted coffee to illustrate. Exercises performed with emphasis on holistic coffee analysis (considering all flavor aspects together) and introduction to descriptive cupping and its applications.

July intermediate training program (2-day): Introduction to espresso drinks and espresso blends. For this session, sample roasters and an espresso machine will need to be available to participants. Theory includes the different balance of tastes that results from the espresso brewing process and the emphasis on mouth feel. A cupping method is introduced where the coffee is cupped in the usual way, as an espresso diluted to regular cupping strength, and an actual espresso. Participant exercises include making and tasting various espresso beverages and designing an espresso blend in groups for a final presentation.

October beginning training program (4-day): Repeat of program detailed here with agreed upon changes as necessary.

Conclusions

As the Bolivian coffee industry develops, it will face an increasing need for cuppers to control quality and to choose and develop products to meet the needs of various markets. This will require increasingly sophisticated and targeted market knowledge based in cupping training and practice. The beginning cupping seminar given was enthusiastically received and 90% of the participants were able to demonstrate the majority of cupping skills taught during the program. A further program of practice sessions and other seminars has been suggested, along with a certification process.

Appendix I: Course Outline

Training Cuppers Outline: Beginning Cupping 4-day Seminar (2-three hour sessions/day)

Day 1: Introduction and Cupping Basics

A.M.

- I. Introduction
 - a. Why cup coffee? The goals
 - i. Determine that certain poor flavors are not present
 - ii. Define and quantify the more desirable flavors that are present
 - iii. Use the information gathered to determine if the sample will meet the needs of the customer and/or determine the value of the sample
 - b. Origins of coffee flavor
 - i. The green bean
 - ii. The roast
 - iii. Freshness
 - c. The process of sensory analysis
 - i. Physical aspects: modes of perception
 - ii. Psychological aspects that can affect what is perceived (discussion of the concept of “sensory errors”)
 - iii. How coffee cuppers develop: what to expect
 - d. Reporting those perceptions: use of classifications of experience and scales
- II. How to cup: test protocols
 - a. Importance of consistent sample preparation and protocols
 - b. Coffee to water ratio
 - c. Grind
 - d. Water
 - i. Temperature
 - ii. Quality
 - e. Procedure
 - i. Evaluate fragrance by gently shaking grounds in cup and gently sniffing (discussion of how to get the most aromatics in contact with the olfactory bulb)
 - ii. Evaluate fragrance of crust after water infusion
 - iii. Evaluate aroma of coffee by breaking crust (techniques demonstrated)
 - iv. Evaluation of liquor
 1. Perception of tastes: acidity, sweetness, salt (roughness), and bitterness
 2. Perception of mouthfeel: body, smoothness, astringency
 3. Perception of finish: time aspect of experience
- III. Break, prepare for cupping (15 minutes)

First cupping: 3 samples:

 - *Honduras 1*
 - *Zambia*

• *Papua New Guinea*

P.M.

- IV. Expressing and reporting perception
- a. Qualitative:
 - i. Classification of experience: use of nominal scales
 - ii. Description of experience: greater detail

Cupping 2: Bolivian coffees reflecting the following qualities

- *High acidity*
- *Low acidity*
- *Sweet coffee*
- *Rough coffee*

- b. Quantitative
 - i. Intensity of experience: numerical, linear, or exponential scales
 - ii. Relative relationship of one to another
 - iii. Ranking according to specific criteria (preference, most acidic, etc.)

Cupping 3: Coffees with different levels of acidity (4 samples)

- *Nicaragua 1*
- *Brazil*
- *Colombian 2*
- *Kenya AA*

- V. Review
- a. Cupping is a form of sensory analysis that involves physical and psychological factors
 - b. Using the sensory system as a means of measurement requires:
 - i. Consistent methods of sample preparation and analysis
 - ii. Consistent methods of reporting
 1. Qualitative
 2. Quantitative
- VI. Going forward; what to expect in the next few days
- a. First, will go into the details of the different aspects of perception, especially aromatics and taste
 - b. Will use those skills to examine various parameters of the coffee product
 - i. Methods of processing (wet, dry, semi-pulped) in the green stage
 - ii. Degrees and parameters of roasting
 - c. Final test
 - i. Necessary so that presenter knows what is being understood
 - ii. Allows student to put their knowledge into practice
 - iii. Reflects real world applications

Day 2: Aromatics and tastes

A.M.: Aromatics

- I. Aromatics introduction
 - a. Most varied perceptions
 - b. Most fleeting perceptions: not everyone gets the same thing always
 - c. Connected to emotions in a special way
 - d. Important aspect of coffee and overall flavor response
 - e. Mainly qualitative; some aromas are naturally stronger and more easily than others. Most highly valued coffees tend to have the most subtle (but perceptible) aromas.
- II. Types of coffee aromatics and where they come from
 - a. Sugar browning reactions: the basics
 - i. Sweet
 - ii. Toasted
 - iii. Maillard reactions
 1. Sulfur
 2. More exotic aromas
 - b. Fruit
 - c. Floral
 - d. Nuts
 - e. Chemical
 - f. Woody
 - g. Spicy
 - h. Chemical
 - i. Earthy
 - j. Dark roast

Exercise 1: Use Le Nez du Café set of coffee aromas at different stations, grouped according to the above categories. Participants are introduced to the procedure of testing each other on the scents. 1 hour practice session.

Break (15 minutes) to set up and grind for cupping

Cupping 1:

- *Colombian 3*
- *Ethiopian Yergacheffe*
- *Bolivian*
- *Honduras 2*

P.M.: Tastes

- III. Tastes are more regularly perceived than aromas and panelists have greater agreement
 - a. Perceived within the mouth especially on the tongue and roof of the mouth
 - b. Explanation of Fechner's law and its importance to cupping: the taste system responds to change in level, not in absolute levels
 - c. Types of tastes
 - i. Primary flavor aspect of coffee: acidity
 - ii. Sweetness
 - iii. Salt (potassium)
 - iv. Bitterness: mainly an aspect of roast

Exercise 2: Tastes

Individual tastes (sour, sweet, salt)

Types of acidity

Citric acid

Malic and tartaric acid

Acetic acid

Acidity modified by:

Sweet only

Salt only

Sweet and salt

Cupping 2: Bolivian coffees illustrating the following

Dominant acidity

Acidity modified by sweetness

Rough and/or bitter with some acidity

Day 3 (2 separate topics)

A.M.: Mouth feel and combined attributes

- I. Mouth feel: the tactile sensations
 - a. Body: feeling of heaviness, viscosity
 - b. Smoothness: Granular vs. oily
 - c. Mouth feel descriptors
 - i. Buttery
 - ii. Syrupy (usually combined with sweetness)
 - d. Astringency: mouth-drying
- II. Interactions between flavor attributes
 - a. Perception of certain taste perceptions cause one to expect and be sensitive to certain aromas and vice versa
 - b. Astringency can affect overall perception
 - c. Reinforcement vs. contrast
 - d. Expectations based upon other observations
- III. Combined aspects
 - a. Flavor: combination of tastes and aromas
 - b. Balance: how all flavor aspects work together
 - i. Mutual reinforcement
 - ii. Contrast
 - iii. Cancellation
 - c. Complexity vs. simplicity
- IV. Time aspects: order of perception
 - a. Can help the cupper focus on certain aspects
 - b. The whole must always be considered along with the details
 - c. Finish or aftertaste: important consideration in coffee

Cupping: Illustrations of these concepts

- *Colombian 4*
- *Honduras 3*
- *Sumatra Mandheling*
- *Nicaragua*
- *Bolivian (#1433)*

P.M.: Flavor Faults and Taints

- I. Off-flavors: generally agreed to be unpleasant, but an acceptable level may exist
 - a. Quality of coffee is often defined by presence or absence of faults
 - b. Levels
 - i. Taint: present but not overwhelming
 - ii. Fault or defect: extremely unpleasant or overwhelming
 - c. Types of off-flavors
 - i. Dirtiness and earthiness
 - ii. Ferment
 1. Fruitiness
 2. Winey, different definitions on different continents
 3. Sour
 4. Ferment
 5. Stinker
 - iii. Mold
 1. Hard or harsh
 2. Phenolic (can also be caused by application of certain chemicals)
 3. Mildew
 - iv. Other taints and faults can be picked up by coffee if it comes into contact with aromatic substances

Defects cupping

- *Ferment*
- *Pulpas*
- *Moho*
- *Woody, rough*

Day 4:

A.M.: Roasting and its affect on coffee flavor

Begin with cupping: same coffee roasted 5 different degrees, from light to dark

- I. Roasting basics
 - a. Application of heat to green coffee
 - i. Final roast degree dependent upon amount of heat applied over time
 - ii. Coffee bean is resistant to heat
 1. Like most seeds, is mostly cellulose, an insulator
 2. Speed at which bean takes on heat due to conductivity
 - a. Conductivity of heat into bean mainly due to moistures, oils, chemical changes
 - b. Size of charge and size of individual beans
 - c. Density of beans
 - b. Stages of roasting
 - i. Drying stage: green to jade green to straw colored
 - ii. Roasting until first pop: straw to gold to brown to deeper red/brown
 - iii. Roasting after first pop until second pop: deeper red/brown to dark brown
 - iv. After second pop: dark brown to oily black/brown
 - c. Flavor development as the result of roast is due to amount of heat absorbed by the bean over time
- II. Flavor changes during roasting
 - a. Degradation of certain flavor-producing chemicals
 - i. Trigonelline: moving from bitter flavor to roasty aromatics and nicotinic acid
 - ii. Chlorogenic acid, moving from bitter/astringent to quinic acid (acidic/bitter) and phenols (astringent)
 - iii. At higher roast levels, acids degrade
 - b. Development of flavor
 - i. Sugars are modified through various browning reactions: result of sugar degradation and/or combination with other substances
 1. Caramelization
 2. Maillard reactions
 - ii. Body: loosening of cell walls, distribution of oil
 - iii. Development of acidity up to a point, then degrades
 - iv. Salts do not degrade
 - v. Development of dark roast flavors and bitterness
- III. Degree of roast and affect on flavor (chart and explanation)

Cupping 2: Different medium light to medium dark roasts reflecting different levels of development

- IV. Determining a level of roast
 - a. Roast should be appropriate to the product
 - i. Emphasize the most attractive potential of the green bean
 - ii. Some flavor attributes must be developed
 - iii. Some flavor attributes must degrade to reveal other flavors
 - b. The entire flavor profile should be considered
 - i. Balance
 - ii. Emphasis of certain attributes
 - iii. Development of acidity: hits a peak then degrades as the roast is longer
 - iv. Development of body: a function of degree of roast
 - v. Development of aromatics: allow enough roast time to develop Maillard reactions
- V. The cupper at origin should consider how the product will be used by the final consumer/roaster
 - a. Bright/lighter roast: emphasizes acidity and more delicate flower/fruit aromatics
 - b. Darker: emphasizes body, sweetness, more chocolaty/nutty aromatics
 - c. Dark roast styles
 - d. Espresso

P.M. The Professional Cupper

- I. Use of forms for communication of the sensory experience
 - a. Use of a standard language and format to express perception
 - i. Qualitative expression: identity or classification of the perception
 - 1. How is the flavor attribute perceived?
 - 2. How it is typically named?
 - ii. Quantitative expression: intensity of the perception
 - 1. Can be marked on a linear scale
 - 2. Can be marked on an ordinal scale
 - 3. Can be marked on a categorical scale (includes numerical)
 - b. Most forms ask the cupper to express both qualitative and quantitative aspects (introduction of chosen standard form)
- II. Skill development goals of the professional cupper
 - a. Recognition of the various aspects of the taste of coffee
 - b. Development of appropriate level of sensitivity
 - c. Objective determination of flavor aspects
 - d. Using language typical within the industry
 - e. Building of a “taste memory,” a sort of mental database of sensory experiences
 - f. Knowledge of how the samples will be used in the intended market
- III. Review
 - a. Aspects of coffee flavor
 - i. Individual perceptions
 - ii. Combined perceptions
 - b. Expression of what is perceived

- i. Qualitative expression
- ii. Quantitative expression
- c. What affects coffee flavor
 - i. Flavor attributes of the green bean
 - ii. How the coffee is roasted

Final Test: 5 coffees to rate

- ***In terms of absence of defects***
- ***In terms of sweetness***
- ***In terms of acidity***
- ***In terms of combined attributes***
- ***In terms of aromatic quality (fragrance and aroma)***

Appendix II: Handouts

Handout for “Fundamentals of Coffee Cupping” Day 1

Introduction

The sensorial analysis of coffee is a necessary aspect in evaluating coffee quality and determining its value in the marketplace. While the emphasis in most grading systems has been on physical aspects (moisture, bean size, number of defects, density) which provide important clues as to the quality of the sample, the only way to determine actual flavor attributes is cupping the coffee by a panel of trained cuppers.

This program is designed to introduce novice cuppers to this practice by developing the cuppers' innate abilities to taste and demonstrating how to apply those abilities in a professional situation. Initially, the techniques of cupping coffee and procedures for the cupping test are introduced. Then specific aspects of flavor attributes are discussed by themselves and as they combine in the tasting experience. Since being a professional cupper requires knowledge of the product and the marketplace as well as cupping skills, coffees from various regions, their methods of production, and their place in the market are discussed.

The path of the cupper is one of constant learning and practice. Relying upon one's own sensory system for information is an everyday occurrence, but at the same time one notices constant change in perceptions. Virtually all cuppers have good and bad days, tastes and preferences change over time, and new flavor experiences can change one's view of the process. It is important for the cupper to keep an open mind and allow new experiences to take place, even seeking them out.

At the same time, consistency of evaluation is the mark of professionalism. This requires constant practice and honest evaluation of one's skills. Well-practiced and knowledgeable coffee cuppers are becoming a requirement at all levels of the coffee business, especially as consumer tastes change and higher quality is demanded. These cuppers can make a significant contribution at any level of the industry by applying and developing their skills while also building their own careers.

I. The Basics: Coffee Cupping Procedures

Why cup coffee?

Sensory analysis is the process of using the human sensory system to evaluate foods, beverages, or other materials. It is used in most segments of the food industry (and even in the textile and perfume industry) for product development, quality control, and basic research into why individuals prefer one thing over another. In the coffee industry, the formal process of sensorial analysis is called “cupping.”

This analysis is used to determine the relative quality of a sample of coffee. Quality is defined differently by different people, but ultimately it is the customer, the person who will actually pay for the coffee, who will determine if a coffee meets their standards. The primary considerations are the flavor attributes of the coffee and its price. It is the job of the coffee cupper to determine the quality and level of flavor attributes of the sample in order to classify it according to market demand and willingness to pay a certain price.

The success of a coffee product depends upon its appeal to the targeted customer. These customers are segmented into groups depending on their preferences of flavor attributes, attitudes toward the product, use of the product, and cost. Preferences in coffee flavor are complex and vary with culture and region. Attitudes towards the product range from a method of ingesting caffeine (the “commercial” segment) to carefully studying all aspects of the product (the “specialty” segment), with many gradations in between these extremes. Roasters seek to meet the needs of consumers, whose uses of coffee include espresso preparations, home use, morning pick-me-up, or evening beverage accompanying dessert. Cost is what the customer is willing and expecting to pay for the preferred experience.

All customers wish to believe that they are getting the highest value depending on their desires, the highest quality for the least cost. If the cost is higher, quality must be perceptively higher. Coffee quality depends upon the flavor attributes and the customers’ preference and ability to perceive those attributes.

The coffee cupper plays an important role in this business of supplying coffee customers with what they desire. Where the marketer determines what is most likely to be sold, the coffee cupper evaluates what flavor attributes are actually present in the coffee. The heart of this process is the cupping session.

A cupping session puts together

1. The samples of coffee
2. The panelists
3. The testing method itself, the means by which these are put together

The Coffee

Coffee is the product itself, also referred to here as “samples.” It is a complex beverage capable of many flavor attributes.

What is responsible for coffee’s flavor?

There are 3 aspects that contribute to the perceived quality of coffee.

1. The green bean components
2. The roasting in terms of time and temperature
3. The freshness of the product

Green bean components: Selection of green bean components is primary determinants of flavor attributes. Coffee is capable of producing a wide variety of flavor depending on species and variety of plant, growing conditions, agricultural factors, and altitude at which it was grown.

Roasting parameters: From a production perspective, roasting is a function of time and temperature, a result of heat applied over time. The degree to which heat is applied during the roasting process will not only determine the final roast degree (most observable to the customer in terms of darkness), but the flavor attributes that develop.

Freshness: Roasted coffee is most preferred when it is fresh and this is realized (though not always practiced) throughout the coffee industry. Freshness is the result of the amount of time between roasting and consumption, exposure to oxygen, water, and temperature (in order of importance).

Green coffee freshness is also important. Changes in moisture can especially effect changes in the capability of coffees to develop flavor attributes in the roaster. Conditions of transport and storage of green coffee must also be considered when evaluating coffee freshness.

Defining the Coffee: what should be there, what should not be there

From a cupper’s perspective, the most important aspect of the coffee is its flavor. While the cupper should be knowledgeable about the physical and market aspects of coffee, their focus is how these aspects manifest as flavor in the cup. A coffee’s quality is decided on the basis of these aspects, from the ground up.

Free of defects: A customer may or may not prefer one coffee flavor over another, but virtually all customers will reject coffee that is unpalatable. As a result, the starting point is that the product must be free of defects. A defect is defined here as flavor or physical condition that renders the product unsuitable for consumption and/or will cause immediate rejection of the product. In terms of coffee, examples include the numerous sensory defects originating in green coffee, such as ferment, phenol taste, or dirtiness. A simple test here is to smell the green coffee. Many sensory defects will reveal themselves before the coffee is roasted.

Less destructive but problematic are “taints.” These flavor attributes are present but not overwhelming to other flavor attributes. They may be acceptable at certain levels and are even desirable in some products and some markets within certain contexts. Examples of the latter are the preference of Northern Germany for “winy/pulpy” coffees (only if the taint is present at a certain level) and the desirability of the trait of “earthiness” in Sumatra Mandheling coffees.

Flavor attributes of the product: Besides being free of defects, the particular qualities and attributes that make the coffee product unique are analyzed during cupping. Some of these qualities and attributes are more directly perceptible than others and some are more difficult to locate in the market, factors to be considered in determining the potential market for the particular sample.

These attributes are defined by cuppers in two ways: (1) the quality of the flavors that are present and (2) the intensity of those qualities. Qualities are defined descriptively in terms of what is experienced and how it is experienced (as a taste, an aroma, or a flavor, for instance); this is discussed in detail in the second and third sections.

The Panelists

Since cupping uses human beings to perform the test, both physical and psychological factors must be considered. As a cupper becomes more experienced and trained, they are better able to know themselves and how they are being affected by their environment. This requires knowledge of self as well as knowledge of the coffee

Physical Aspects

The human sensory system is complex and experiences many stimuli, most of which one does not consciously experience. The sensory system responds to change, not absolute levels of experience. For example, one may not be aware of the temperature in a room if the temperature is moderate and the body has adapted to it. However, if someone opens a door and a gust of cold or hot air blows in, one will suddenly notice the shift in temperature due to the change.

Similarly, the physical impressions a cupper has are comparisons between samples. If one has just cupped a very acidic coffee and the next sample tastes somewhat flat, that sample should be tasted again after another less acidic coffee or after clearing the palate with water.

Another physical consideration is how much cupping one is able to do before “palate fatigue” sets in. This phenomenon, when the cupper cannot make adequate discriminations between samples, occurs as the result of sensory system overload. The ability to cup more samples at a time develops in the professional cupper much in the same way that an athlete gets develops more endurance through practice. When required to cup a large number of samples, it is best to schedule the more subtly flavored coffees earlier in the day.

Psychological Factors

The cupper's state of mind directly affects how they will perceive and rate the coffee. If one is in a poor mood, it will affect how the coffee is rated. Besides one's mood, there are several "sensory errors" that can occur as the result of preconceptions or misinterpretations. These include:

Expectation error: If one has developed any particular ideas about the sample (or if someone has remarked on the quality of the sample), the cupper usually will at least look closely for the suggested qualities and even, depending upon one's suggestibility, find that quality.

Error of habituation: If one tends to cup the same level of samples continually or is in a hurry, one can tend to perceive and rate all samples as the same, despite their being significantly different.

Stimulus error: This can be caused by excessive noise, other odors, or physically uncomfortable situations. The sensory system loses focus on cupping the coffee and details are missed.

Logical error: This is developing one's own preconceptions about the sample based upon logic ("The last 2 were good, so the next one must be bad.") or even superstition (#7 on the table is a lucky sample).

Halo (or "horns") effect: This is rating samples on a particularly "good" table higher than normal (making the assumption that all the samples are good since most of them are good) or vice-versa for a table of poor samples. The "halo" effect raises the scores of mediocre coffees on good tables, while the "horns" effect lowers the scores of samples on tables where poor samples dominate. The latter tends to be more likely in coffee.

Order of presentation: Numerous errors can occur as the result of order of presentation.

- *Contrast effect:* A mediocre sample following a good sample on the table may receive a lower rating than if it had been evaluated on its own; the opposite can also occur.
- *Group effect:* The very first sample tasted is often preferred (since the sensory system is at its most sensitive at that point) and other samples are compared to it as a baseline, usually unfavorably.
- *Error of central tendency:* Samples near the center of a set are preferred.
- *Pattern effect:* Panelists think they perceive a "rhythm" to the presentation of samples (example: "Number 3 always seems best.").
- *Time error:* Cuppers who enjoy their work (most of them) start out with a certain level of enthusiasm, but may be fatigued or indifferent by the end of the day.

These errors are overcome by balanced randomized presentation of samples, allowing samples to appear in different positions on the table in a random order.

Mutual suggestion: Fellow cuppers, friends, and especially bosses who want a certain result can influence a cupper's perception and rating of a sample. A "mob mentality" can develop where a panel can talk each other into rating a sample a certain way by making particular observations. For this reason, it is best to cup in silence and with a minimum of gesticulation.

Lack of motivation: As mentioned, most cuppers enjoy their work most of the time unless undue stress is put upon them. However, it is possible that a cupper does not fully apply themselves to their task for many reasons. All cuppers experience a lack of motivation from time to time.

Capriciousness vs. timidity: These are opposite tendencies that often reflect the personality of the cupper. A *capricious* panelist will tend to use the extreme ends of the scale, while a *timid* panelist will stay within a narrow range. New cuppers tend to be somewhat timid for fear of making a mistake and the unfamiliarity of the situation. On the other hand, cuppers with lots of experience who have developed strong opinions will be more capricious; for them there is no middle ground, only good and bad. The most valuable cuppers that produce the most accurate information rate the samples as they are, without imposing their opinions and beliefs.

These natural tendencies, both physical and psychological, are a constant challenge to the cupper. The professional learns to honestly recognize psychological errors when they occur and adjust their responses as necessary. The best advice is to know these problems, realize when they come up, but don't over-think the process and relax as much as possible during the test, focusing on the flavors of the coffee.

The Test

For a sensory test to be scientifically valid, one must be reasonably sure that the approximately the same results would be obtained if the same test were performed under the same conditions. The following is suggested in order to make cupping as valid as possible:

1. Follow consistent protocols each time one cups.
2. Use a panel; a single cupper, no matter how good, is subject to occasional fluctuation and different sensory systems have different sensitivities.
3. Use standardized forms and methods of measurement that are commonly agreed upon and relate directly to the purpose of the test.

Environment for Cupping

As can be seen from the previous section, creating an environment that is conducive to cupping is important. The following should be considered when setting up a space for cupping.

- Lighting: enough to clearly see but not too much
- Aroma free as much as possible
- Clean and ordered
- Limited distractions, especially noise
- Comfortable temperature
- Spacious, not too crowded, adequate space for amount of samples tested, paperwork, and panelists

Sample Preparation

To ensure replicable tests and valid comparisons, the samples must be prepared the same ways each time. The SCAA (Specialty Coffee Association of America) suggests the following protocols for sample preparation.

Coffee Preparation:

- Roast samples to a medium-light roast in about 8-12 minutes (more details on roasting in section 4)
- Determine capacity of cups in milliliters (ml) (to an accuracy of 2 ml)
- Weigh whole beans at a ratio 8.25 gm per 150 ml water (to an accuracy of 0.05 grams)
- Clear grinder with coffee to be cupped
- Grind each sample individually just prior to cupping

The relative fineness of the grind (size distribution of particles) is also important. The following is suggested.

| Coarse particles (screens 20-30) | Medium particles (screens 14-16) | Fine particles (Pan) |
|---|---|-----------------------------|
| 5-7% | 60-80% | 20-24% |

Infusion:

- Water should be clear & odor free
- Ideal water quality:
 - Total Dissolved Solids ideally 125, but can be between 100 – 250 ppm
 - pH at 6.9-7.3
 - Calcium hardness at 17 mg/L to 85 mg/L
 - Total alkalinity at 10-100 mg/L
 - Sodium/potassium at less than 30 mg/L
- Freshly drawn, poured at 93° C, just off the boil
- Fill cup to the rim
- Steep grinds 3-5 min. before cupping

Cupping Procedures

The cupping procedure should be a step-by-step timed process done in silence. Cuppers on the panel should do their best not to influence each others' perceptions and independently rely on the flavor attributes of the sample to reach and record their perceptions. Suggested procedures:

1. Make a visual check of the roast and mark any deviations observed in the "Roast Color" column of the form (or otherwise note the color of the sample).
2. Evaluate fragrance of dry coffee by shaking the cup and gently sniffing.
3. Infuse cups with freshly boiled water.
4. The unbroken crust is sniffed and evaluated.
5. After 3-5 minutes, the crust of the cup is broken and the aroma evaluated.
6. Clear the crust
7. When the coffee has cooled to a temperature at which it can be evaluated (140-160° F), begin evaluating the coffee.
8. The coffee is evaluated at least 3 times: hot, warm, and tepid.

Summary and Conclusion

Cupping coffee is challenging and demanding. The sensory system on which the cupper depends is changeable and responds differently according to environmental, physical, and psychological conditions. To ensure an accurate and replicable sensory test, cupping procedures must be stringently followed. However, with regular training, practice, and following defined protocols, the coffee cupper can play a major role by determining how the flavor attributes of a sample meet the needs of specific customers. This can add considerable value to the coffee produced in the origin.

Handout for “Fundamentals of Coffee Cupping” Day 2

A cupper’s training is a progression of understanding based upon factual study and direct experience. Knowledge alone is not enough; a good cupper must constantly train his or her sensory system. At the same time, a good factual basis is necessary so the cupper is able to put their experience in context and make reasonable conclusions based upon their perceptions.

The learning process for cupping is gradual. Like training for an athletic event, the cupper’s sensitivity develops with use over time. One also must find which techniques of slurping and spitting work best. The degree of concentration that can be maintained by the individual for longer periods also develops. The amount of cupping that can be accomplished before “palate fatigue” (the point at which perception is less clear to the cupper) sets in also extends with daily cupping.

The flavor of coffee is the result of many different compounds and perceptions. Communicating what one tastes can be a challenge. In order to make sense of all these sensations, the coffee cupper deconstructs the coffee experience in several ways.

The main method of deconstruction is to break the coffee flavor down into how it is perceived. The human sensory system includes the olfactory system (aromatics, perceived by the olfactory lobe in the upper nasal cavity), taste sensations (the sweet, sour, salt, bitter, and other perceptions perceived on the tongue and upper palate), and tactile perceptions (perceptions of hot and cold, texture, etc.)

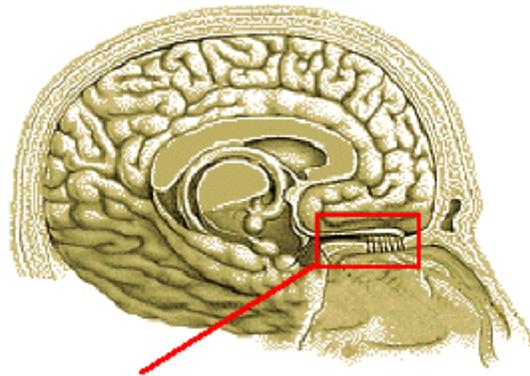
The starting point is to learn about the building blocks of flavor attributes and how they are perceived. This section focuses on two of the most important aspects of cupping coffee, aromatics and gustatory sensations.

Aromatics

The aromatics of a coffee are perceived by the cupper in stages. Before the coffee is infused with water, the freshly ground coffee is analyzed. This aspect is referred to as the fragrance of the coffee. After the coffee is infused with hot water, the aromas are analyzed, first by sniffing the crust, and then by breaking the crust.

By far, aromatics are the most complex aspects of a coffee’s character and the aromatic sense is the most sensitive aspect of the human sensory system. Human beings are capable of perceiving and remembering close to 10,000 different aromas. Several thousand of these have been found in coffees due to their different origins and roast levels.

However, because of its complexity, coffee aroma presents some difficulties. Some aromas are delicate and fleeting, appearing for only a short time. This is because the molecules that cause aromatic perception may or may not make it up the nasal passages to the olfactory lobe where they will be sensed by the cupper (see Figure 1). Since so many aromatic molecules are released quickly upon breaking the crust, the cupper may or may not notice particular aromatics. As a result, aromatics are often a subject of disagreement between cuppers.



Olfactory Region (*Regio olfactoria*)

Figure 6: The olfactory lobe is the organ that perceives aromas and is located at the top of the nasal passages.

Notice in Figure 1 how close the olfactory lobe is to the base of the brain. It is in this region that an individual processes emotions and various smells can awaken certain feelings. It is said that if one sees a picture of their grandmother's kitchen, they will remember her, but if they smell something like Grandmother used to make, for a second they will be in the kitchen with Grandmother.

The olfactory system is also the most delicate and fragile system, subject to buildup and fatigue more quickly than the other sensory systems. If a cupper feels that they are becoming less sensitive to aromatics, sniffing the surface of warm water and waiting 2-3 minutes may help clear the nose. This is one area in which daily practice is necessary to keep up and develop one's abilities.

From a perspective of technique, gentle sniffing is recommended. Each cupper must discover their own best technique for allowing enough air intake to carry the aromatics up to the olfactory lobe.

Methods of Aroma Classification

Aromatics are evaluated in terms of their intensity and descriptive qualities. Since humans are capable of perceiving and remembering several thousand different aromas, it is not surprising that many different aromatics are used to describe coffee. Since there is such an abundance of aromas, several systems of breaking them into groups have been developed. One that is often used by the wine industry is Henning's Aroma Prism.

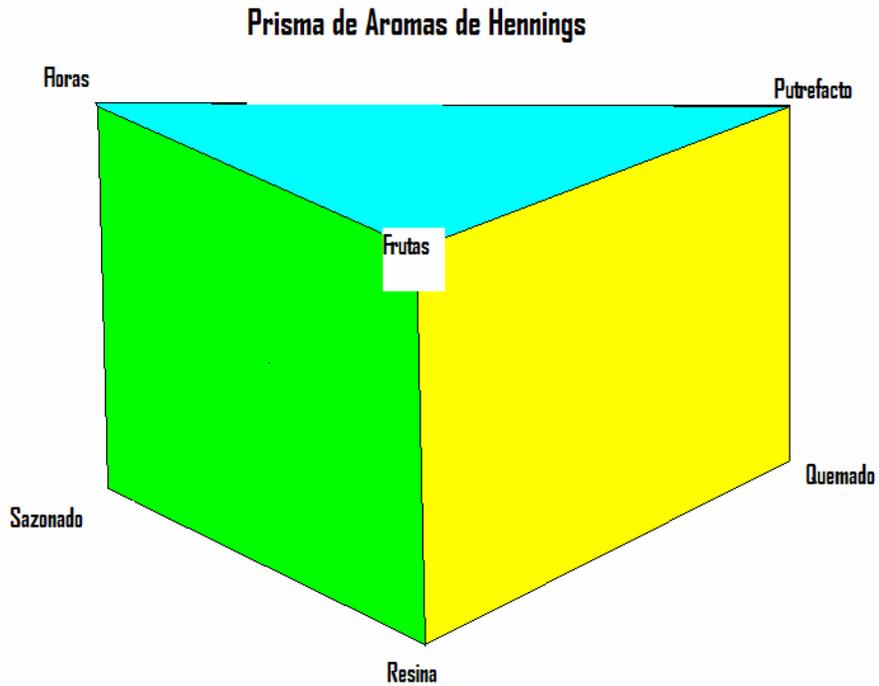


Figure 7: Henning's aroma prism.

This is based upon the idea that some aromas are more likely to be perceived with others. For example, one might find flowers (floras), fruits (frutas), spiciness (sazonado), and resin (resina) aromas together (the green side of the prism), but one would not find flowers, fruits, and burnt (quemado) aromas together.

Another system of aromatics (combined with gestation sensations) is the SCAA's flavor wheel. This is shown in Figure 3.

Gustation

Since the liquid must contact the gustatory senses at least 2 seconds before registering an effect and since there are only 5 basic gustatory sensations, this sensory system is much more regular. The gustation aspects of coffee can reveal a lot of information about the sample's quality.

Gustation Qualities

The 5 sensations are:

1. Acidity
2. Sweetness
3. Saltiness (actually potassium, also referred to as "roughness")
4. Bitterness
5. Umami (savoriness, not important in coffee)

Bitterness is mainly the product of roasting dark, though some green coffees that lack sweetness and acidity will be perceived as bitter. The main issue for the coffee cupper is the interplay between acidity, sweetness, and roughness.

The main gustatory sensation in coffee is acidity. This sensation is modified by the other gustatory sensations. If acidity is modified by sweetness, it is generally favorable, but if modified by roughness, it is generally unfavorable. One can see on the SCAA flavor wheel in Figure 3 that certain combinations of qualities result in descriptions common in the coffee industry.

Qualities of acidity: There are over 21 different kinds of acids produced by roasting and the plant itself produces several variations of fruit acids. In combination, these help to give coffees from certain origins distinctive flavor profiles. For example, it has been found that higher levels of phosphoric acid are responsible for the unique flavor of Kenya coffees.

The dominant fruit acid in coffees is citric acid. Also present are volatile aromatic acids (such as acetic acid, or vinegar), other fruit acids (such as malic acid found mainly in apples and tartaric acid found mainly in grapes), and chlorogenic acids (including quinic and caffeic acid that result from roasting). The latter is usually perceived as more bitter than typically acidic.

When a cupper considers the quality of the acidity, they must take into account (1) the quality of the acidity itself (the fruit acids are more desirable) and (2) the other gustatory qualities that modify the acidity.

Gustation Intensities

One perceives the intensities of the various gustation sensations in terms of Fechner's Law. This states that the change in perceived intensity of an added flavor depends upon how much of that flavor is already present.

For example, if one puts a teaspoon of sugar in a cup of coffee, the difference between the coffee without sugar and the coffee with sugar is quite intense. Add another teaspoon and the perceived difference between the coffee with one teaspoon and the coffee with two teaspoons is not as great, even though twice as much sugar has been added. There will also come a point, called the "saturation threshold" where one will not perceive a difference in sweetness regardless of how much more is added. This is illustrated in Figure 4.

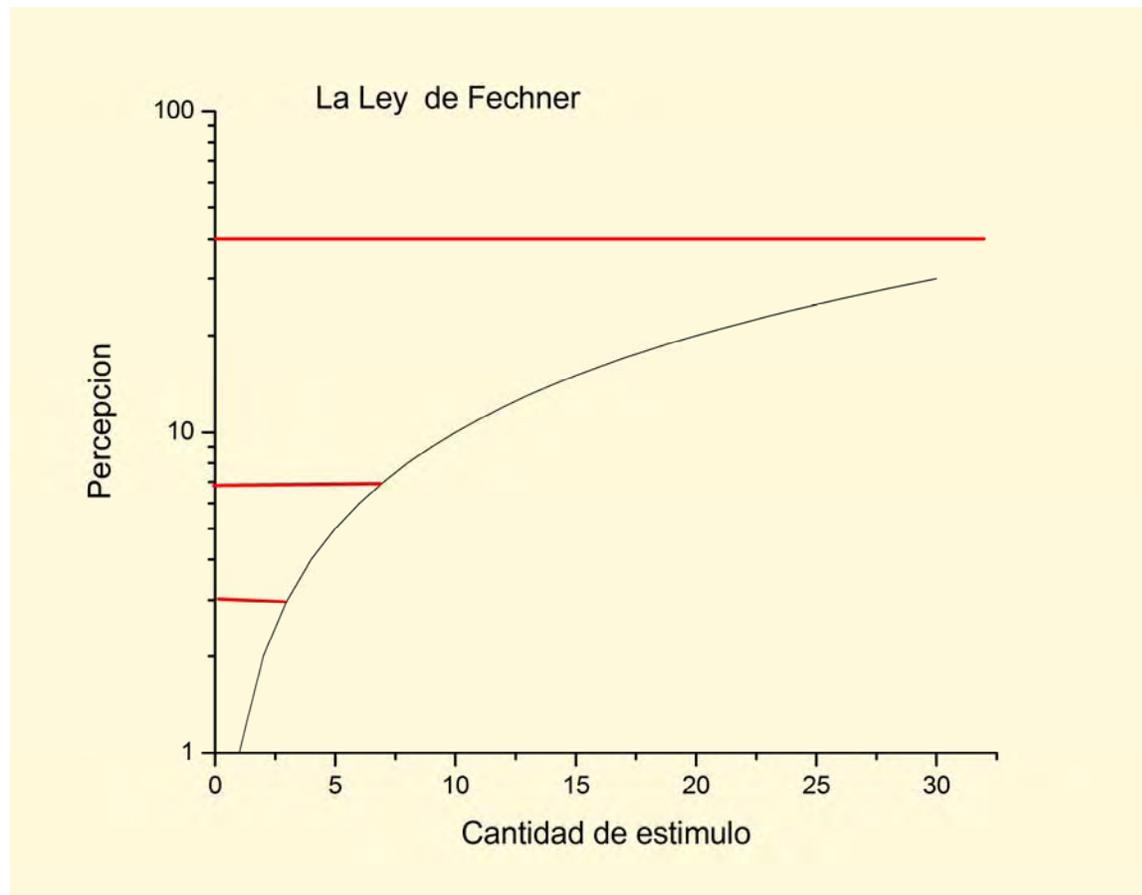


Figure 9: Fechner's law. As more of a substance is added, the difference becomes less perceptible.

The cupper must consider this in rating the intensity of the various qualities. For one coffee to be sweeter than another, much more sugar must be present.

Learning about the coffee through its tastes

In various combinations one can learn a lot about the quality of coffee and how that quality was produced. Examples are given below.

Acidity and quality of acidity can indicate:

- The origin of the coffee through the unique combinations of acidity present
- The altitude at which the coffee was grown (the higher grown, the more acidic, and higher grown coffees tend to have more complex fruit acids)
- Humidity of the climate: higher humidity produce greater concentrations of fruit acids
- Aspects of cultivation: for example, coffee grown in shade generally produces about 16% more acid
- Aspects of processing: coffee processed by the natural method has less acidity than coffee processed by the wet method

Intensity of sweetness indicates

- Altitude (10% more sucrose for each additional 300 meters)
- Humidity of the climate: more sugar is produced in higher humidity
- Plant material (Arabicas produce 100% more sugar than Robustas)
- Harvesting aspects: more mature cherries have more sugar
- Aspects of cultivation: coffee cultivated in shade has 3% more sugar
- Processing aspects: if coffee is dried under conditions of high temperatura, it will lose sugar

Intensity of roughness indicates

- Altitude (the higher grown, the less roughness)
- Aspects of cultivation: if the coffee tree has not been fertilized or is otherwise unhealthy, sugar will not develop and a rough taste results

Summary

Aromas and gustation responses are the basic building blocks for coffee flavor. Aromas are the most varied and distinct, while the gustation responses are the most regular and generally agreed upon by a panel of cuppers.

Aromatics are classified in many different ways using different descriptors. Some aromas are naturally stronger than others.

Gustation aspects can reveal a great deal about the coffee, from how it was grown and processed to who would be most likely to use it in the marketplace.

These flavor attributes require constant practice to maintain cupping skills and are the basis for coffee cupping.

Handout for “Fundamentals of Coffee Cupping” Day 3

Having looked at cupping as a method of coffee analysis and focused in some detail on gustation and aromatics, it is time to look at the final single attribute and how all flavor attributes combine.

The “Tactile” Sensation

There are nerves on the skin’s surface and within the skin that are sensitive to pressure, temperature, and other physical stimuli. Some areas of the body are more sensitive than others. For example, the tips of the fingers are fairly sensitive. One can easily tell if a surface is smooth or rough, hot or cold by running the tips of the fingers over it. These are called the “tactile” sensations.

Some very sensitive nerves of this type also exist in the mouth. They can perceive the texture and temperature of food in a variety of ways, whether meat is tough or tender, if the asparagus is stringy, if the hot cereal is thick, or if a liquid is oily or watery. How these sensations are perceived by the cupper is referred to here as “mouth feel.”

When one applies pressure on the liquid by pushing it against the roof of the mouth, the liquid can feel thin or viscous and thick. This is “body” and it greatly adds to the pleasure of a cup of coffee. It is the result of all the solids extracted from the coffee during the brewing process, including cell walls loosened during roasting and oils.

An additional aspect of the mouth feel is smoothness. The coffee liquor can feel smooth or granular in the mouth. Some particularly smooth coffees are described as “buttery.”

Mouth feel is not a specific flavor, but it can be modified by other flavors. Sweeter coffees tend to also have heavy body (these are often described as “syrupy”). Perception of mouth feel tends to happen later in the flavor experience as the liquid is pushed around the mouth.

Astringency

One other important sensation to consider is “astringency”. Coffee (like other foods) inherently has some astringency, though in the sweetest coffees it will not be as perceptible. Some classify the sensation as a “taste”, but here it is considered as a mouth feeling since it has a direct effect on structures of the mouth.

Astringency is mostly the results of phenols that derive from a coffee’s chlorogenic acid. They actually dry up the salivary glands under the tongue. The sensation is one of drying and a puckering of the mouth.

Where most consider the opposite of sweet to be sour or bitter, in terms of coffee the opposite of sweet is astringent. Sweetness is the result of selection of ripe cherries during harvesting and good processing practices. Less mature coffee has more chlorogenic acid (causing more astringency) and less sucrose (causing sweetness) to balance that.

Astringency can be a source of confusion. Since excessive chlorogenic acid also causes more development of quinic and caffeic acid, cuppers may interpret their perceptions as more acidic than astringent. The sensation of astringency is strong and may also interfere with other perceptions.

Combined Sensations

It is one of the cupper's goals to not only look at the details of the flavor, the acidity, sweetness, aromas, etc., but also view the coffee as a single whole experience, much as the consumer will view it. A consumer may note particular attributes, but usually forms a response of "like" or "don't like."

When flavor attributes combine, a number of responses can occur. Perception of certain aroma perceptions cause one to expect and be sensitive to certain tastes and flavors. The reverse can also happen. As previously noted, astringency can affect overall perception. In some cases, tastes will reinforce each other, causing a stronger overall flavor (for example, sweetness tends to reinforce fruit acids in a way that is pleasing. On the other hand, some flavors will cancel out each other (sweetness again can cancel roughness and other unpleasant sensations, another reason it is so desirable in cup). Different flavor attributes may also provide a stark contrast to one another, which may be pleasant or unpleasant.

There are different ways of thinking about combined attributes. Most common are the following.

Flavor: The flavor of a substance is the combined sensation of aromas and tastes. For example, a lemon has a specific balance of aromas, acidity, and sweetness that are immediately recognized as "lemon." The flavor "orange" has some similar characteristics, but is distinct from "lemon." Aromas and tastes in coffee combine to form certain impressions as well.

Balance: The term "balance" is used to describe how different flavor attributes work together. One can examine how the different tastes balance one another, how the acidity and sweetness balance for instance. The cupper can also observe how the whole cupping experience of a sample balances out. Is there more acidity than body? Do the aromas dominate?

Time aspects: It has been observed that the perception of coffee flavor changes as the coffee goes from hot to cold, which is why the cupper must evaluate the coffee at various temperatures in order to obtain a full evaluation. Another time aspect to consider is how the various flavor attributes follow upon on another. Usually, the first perception upon ingesting the sample is acidity. Sweetness, various aroma perceptions, etc. follow. The cupper finds it useful to slow this process down by paying particular close attention to what happens initially, what occurs next, and so on. Experiencing the coffee in this way can help the cupper perceive certain details that would otherwise be missed.

An important time aspect of coffee analysis is "finish" or "aftertaste," the flavor attributes that remain after spitting or swallowing. A coffee can have a long or short finish which may be pleasant or unpleasant. A long lingering sweetness is a pleasant sensation, but if one is left with bitterness and/or astringency the impression will not be pleasant. Some acidic coffees finish

quickly, but it is a clean finish (referred to as “snap” by some cuppers). Some coffees just fall away in flavor; this is not as pleasant.

Taints and Faults

As stated at the beginning, one of the primary functions of the cupper is to determine if there are unpleasant flavor attributes present in a sample. The quality of a coffee is often defined by the presence or absence of faults. If there are distinctly poor flavors, the value of a coffee is always reduced, but one of the most important functions of a cupper is to determine to what extent the problem has occurred.

Off-flavors are generally agreed to be unpleasant, but an acceptable level of intensity may exist, depending on how the product will be used. As a taint, the off-flavor is present but not overwhelming; at times it may be barely noticeable to all but the most sensitive cupper. In the form of a fault or defect, the off-flavor is extremely unpleasant or overwhelming, rendering the coffee unfit for its intended use.

The highest priced coffees usually have higher standards in terms of acceptable levels of contamination, but some coffee products command higher prices for having flavors that would be unacceptable in other coffees (an example is the “earthiness” expected to be present in Sumatra Mandelings that would be unacceptable in most South and Central American coffees). It is the job of the coffee cupper to recognize not only the flavor, but the appropriateness of the flavor within the context of coffee being cupped.

These off-flavors come from a number of different sources and can occur at different times during a coffee’s production.

Dirtiness and earthiness come from the coffee having been in contact with the soil at some point in time. Microbes that naturally exist in the earth take up residence in the coffee and give it the same sort of flavor and aroma that one can perceive by turning over a spade full of fresh soil in the garden. At its most extreme, the fault can taste like being on a dusty road behind a truck.

Ferment and fruitiness are the result of the coffee cherry or bean being infected by certain bacteria. In the wet process of milling the coffee, a lot of acetic acid is produced, but if the coffee bean absorbs too much, an unpleasant sourness results. At the level of “ferment,” also know as “stinkers,” this combines with other aromatic acids to be overwhelmingly powerful. A coffee with this level of a defect is always unacceptable. If a coffee has a touch of this, it is sometimes referred to as “sour.”

The fruit and the mucilage can also become infected and leave a taint on the bean. This results in a taint or defect know as “winy” (though it should be noted that in some usages “winy” refers to pleasant combination of sweetness, acidity, and aroma). The taint is somewhat controversial, with many believing that a touch of this will add some interest to an otherwise clean coffee. Many higher priced dry processed coffees (such as Ethiopians) will have some of this flavor.

Mold can be picked up by coffee at any point in its processing (including shipping and transport) if the right conditions of humidity and heat exists. The resulting taint or defect depends upon what species of mold was picked up. “Hard” or “harsh” flavors (tasting like iodine and typical of cheaper Brazilian coffees) are due to one kind of mold often found on drying patios. Mold can also have “mildew” or “mushroom” flavors.

Phenolic is somewhat controversial because it occurs so irregularly in a sample and it is not known with certainty what actually causes it. It is a flavor much like swimming pool water.

Other taints and faults can be picked up by coffee if it comes into direct contact with aromatic substances, especially when its moisture is still high. The extent to which the coffee is affected is due to the strength of the taint, the length of contact, and the tendency of the coffee to absorb the substance.

Summary

It is the goal of the coffee cupper to get a full picture of a coffee that includes all of the individual details and how they combine and work together. This requires a systematic approach to cupping. First, it must be determined that the coffee has no taints or faults that are inappropriate to their use. Next, the individual flavor attributes themselves should be analyzed. Finally, the cupper must take into consideration how all of the various elements work together and to determine the final quality of the sample.

Handout for “Fundamentals of Coffee Cupping” Day 4

Roasting Coffee

Coffee in its green form represents potential coffee flavor. It must be roasted before being sold to most consumers (though there is a limited trend towards “home roasting” in the U.S. and Europe). The roasting process will have a direct effect on how the flavor of the coffee is finally perceived and enjoyed.

The cupper, even in growing countries, should be familiar with the different levels of roasting, roasting techniques, and their effect on flavor for 2 reasons. First of all, it is an important aspect of sample preparation. In setting up standards for coffee evaluation, it is necessary to specify time, temperature, and final result of roasting so that one can make direct comparisons of flavor. Second, the cupper should know the effects of roasting to understand how the samples they are evaluating will be experienced by the final consumer.

Roasting is a complex topic, but basically roasting occurs through the application of high levels and amounts of heat to green coffee. The final roast degree is dependent upon the amount of heat applied over time. The challenge the roaster has is managing the heat in such a way that it is absorbed by the bean at a rate that will allow intended flavor development.

This is more complicated than it sounds, however. The green coffee bean is resistant to heat since, like most seeds, it is mostly cellulose, an insulator. The speed at which bean takes on heat due to conductivity, mainly due to moistures, oils, and chemical changes that occur as a result of roasting. The roaster must consider the size of “charge” (the amount of coffee loaded into the roaster), size of individual beans, density of the beans, and total moisture. The latter changes as the coffee ages.

Stages of roasting: As the coffee is roasted, it moves through several stages that are observable by eye and nose. During the drying stage, the coffee moves from green to jade green to straw colored and will have a sour-green aroma. As the straw color moves to gold to brown to deeper red/brown, it develops more sugar-browning aromas and the beans expand in size. Finally, a noticeable “first pop” or “first crack” is heard. Roasting further progresses to second pop, taking on a deeper red/brown to dark brown color and changing from sweet to coffee and dark coffee aromas. After second pop, the coffee moves from dark brown to oily black/brown and develops the distinctive dark-coffee aroma and charred aromas.

Actual flavor development is the result of roast is due to amount of heat absorbed by the bean over time. Flavor changes during roasting include processes of degradation, changes in flavor, and combinations of substances that result in other flavors. The main physical changes that occur are expansion of the bean, loss of moisture, and loss of density.

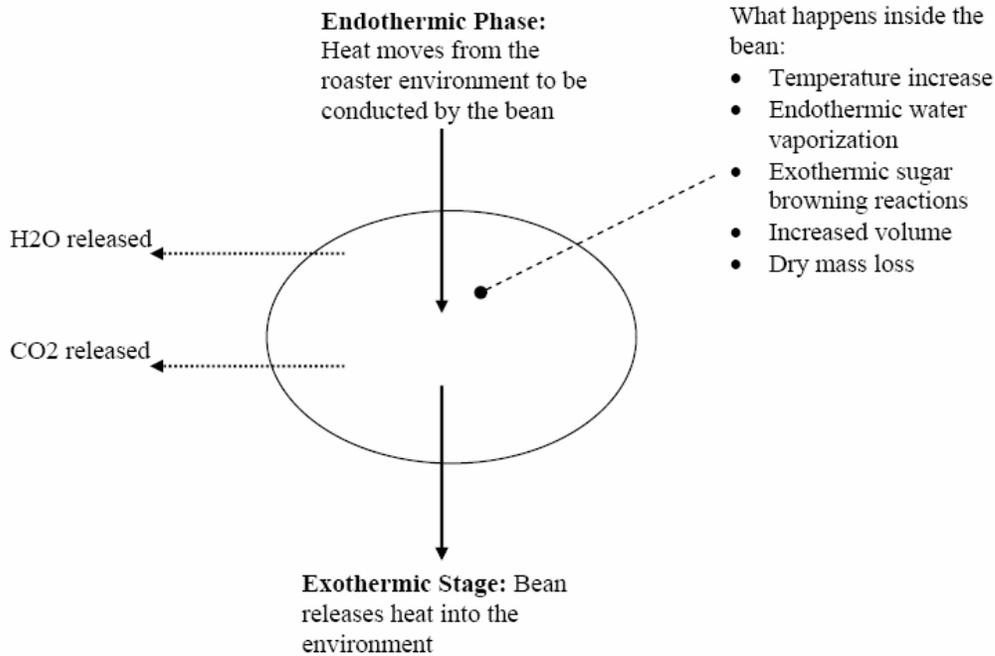


Figure 10: Physical changes during roasting.

Fundamental chemical changes: One chemical present in all coffees is called trigonelline. In its native form in the green coffee, it is very bitter, and gradually degrades during roasting, moving from bitter flavor to roasty aromatics and nicotinic acid. Chlorogenic acid changes from bitter/astringent to quinic and caffeic acids (acidic/bitter) and phenols (astringent). Sugar browning reactions are some of the most important aspects of coffee flavor development, responsible for sweetness and most of coffee's aromatic qualities. At higher roast levels, most acids (the exception being quinic acid resulting from chlorogenic acid) degrade, which has a corresponding effect on flavor. Most important to the cupper, though, is how the flavor changes during roasting.

Development of flavor: As mentioned, sugars are modified through various browning reactions the result of sugar degradation and/or combination with other substances. When a sugar undergoes caramelization, it loses carbon dioxide and moisture and develops a less sweet but more aromatic character. In a Maillard reaction, the browning sugar joins with an amino acid to produce a unique aromatic (most roasted aromas, such as roasted chicken or baking bread are the results of Maillard reactions). Body occurs as the result of the loosening of cell walls and re-distribution of oil within the bean. In the first stages of roasting, acidity increases, but then degrades. The salts that cause roughness do not degrade during roasting. Finally, dark roast flavors and bitterness develop in the latter stages of the roast.

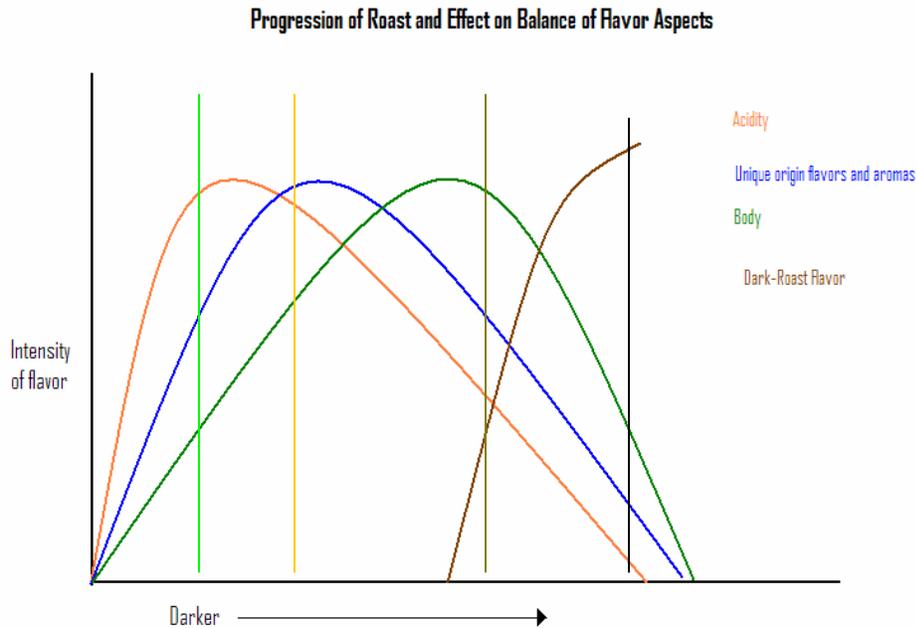


Figure 11: Flavor development as the result of roasting. Lines represent the different levels of roast discussed below.

The flavor balance of coffee changes as the roast proceeds from light to dark. The first occurrence is the development of acidity due to degradation of sugar and chlorogenic acid; at this stage most of the sucrose is still present but not perceived due to the overwhelming acidity. Perceived acidity hits a peak, and then degrades as the roast is extended. Perception of unique aromatics occurs as sugar browning reactions proceed and also hit a peak. Development of body, a function of degree of roast, happens later in the process. Last to develop are the dark-roast characteristics.

While standards of roasting for cupping analysis should be established and consistent, the cupper at origin should consider how the product will be used by the final consumer/roaster and what flavor profile will result. The following discuss these in more detail.

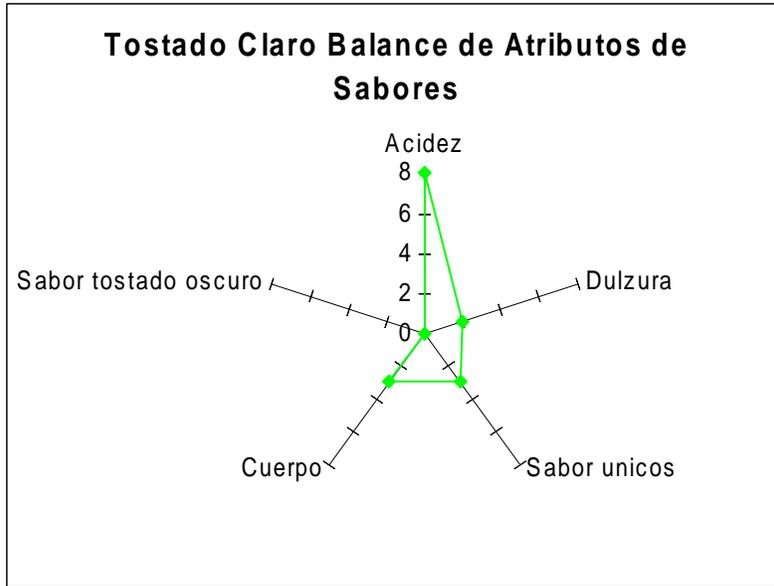


Figure 12: Very light roasted coffee

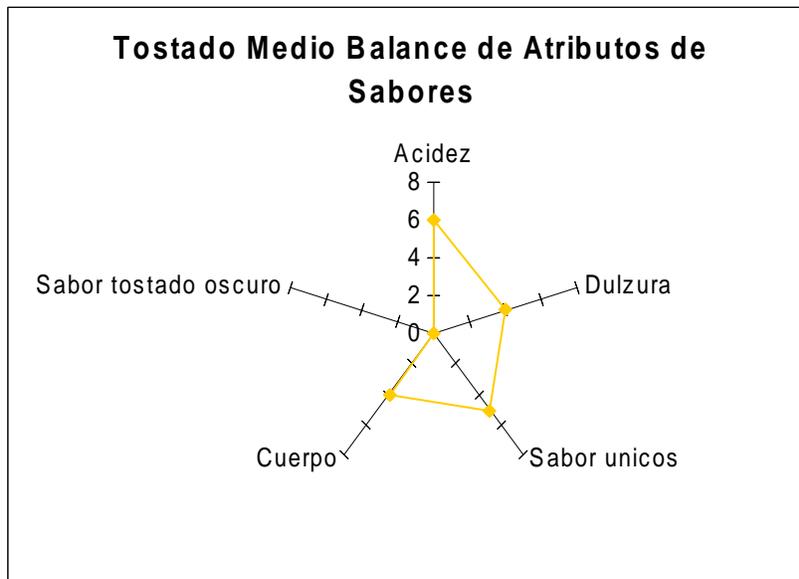


Figure 13: Medium-light coffee

At the lightest roasts (Figure 3) the emphasis is on acidity. Gradually, sweetness and the more delicate flower/fruit aromatics unique to the particular origin can be detected. This area represents the typical cupping roast.

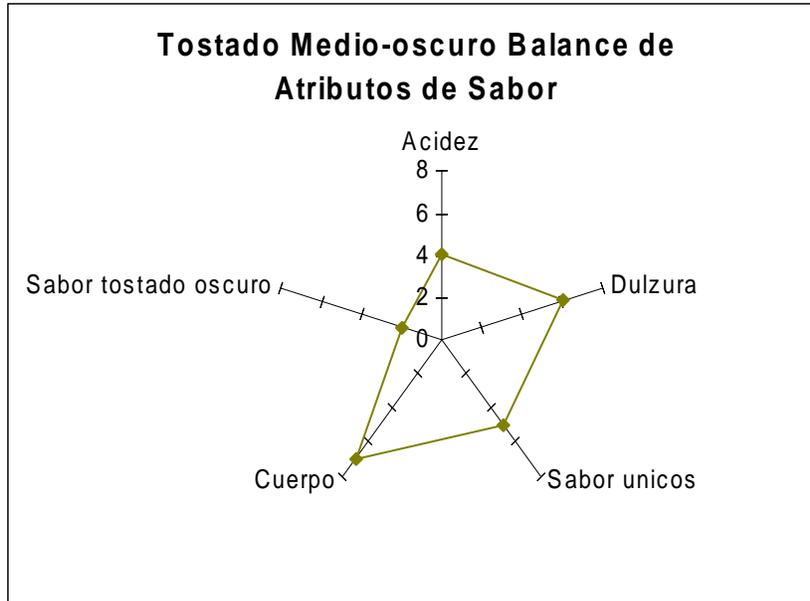


Figure 14: Medium-dark roast

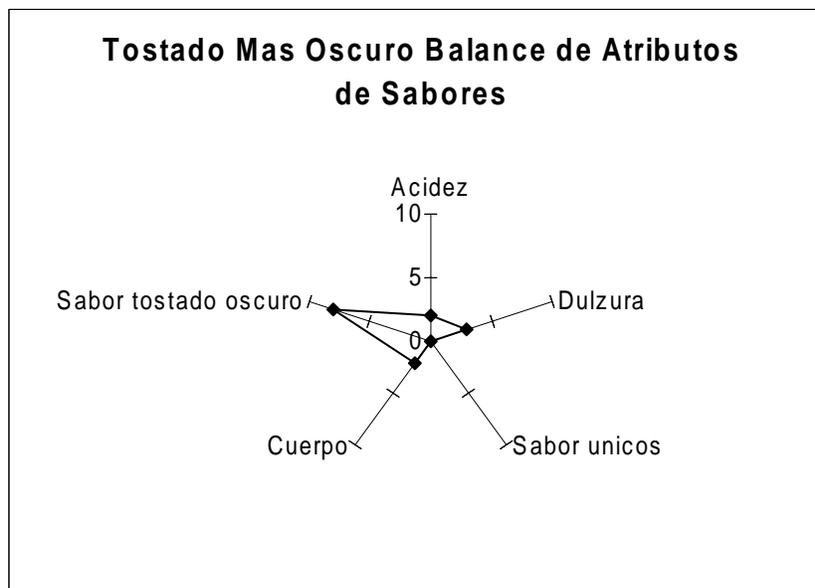


Figure 15: Dark roast.

As the roast moves darker the flavor profile emphasizes body, sweetness, and the more chocolaty/nutty aromatics. Finally, at the darkest roasts, all unique origin flavors are gone, acidity, sweetness, and body are lowered, and the emphasis is on dark roast coffee.

In determining a level of roast, the roaster seeks to emphasize the most attractive potential of the green bean. Some flavor attributes must be developed, while some flavor attributes must degrade to reveal other flavors. They must consider the entire flavor profile should be considered, balance, and the particular flavor attributes they wish the product to have.

It is sometimes difficult for those not used to such flavor profiles to understand dark roast styles. Once again, it goes to customer preference, what they are used to, and how the product will be used. For example, espresso accentuates the acidity through its brewing process; as a result those products used in the making of espresso tend to be darker roasted.

The Professional Cupper

The professional cupper seeks to constantly increase cupping skills. Most important are the recognition of the various aspects of the taste of coffee. As cuppers progress, they also develop a greater level of sensitivity to certain aspects.

When one is a beginner at any skill, it pays off in the long run to initially focus on the task in great detail so that one will not develop poor habits. Suggested protocols of cupping have already been detailed. For the internal cupping process itself, the following is suggested as a procedure.

- Determinar que el café no está con fallas o contaminación
- Analiza los atributos de sabor individual
- Analiza los atributos de sabor en combinación
- Analiza aspectos de tiempo
- Considera una visión general y los detalles

When first starting out, this may take more time. However, as one's skills develop, recognition of certain flavor attributes becomes quicker and the cupper becomes more efficient. Constant cupping also will allow the cupper to taste more samples in a session accurately, much as an athlete trains to build up endurance.

The goals of a coffee cupper are as follows:

- d. Objective determination of flavor aspects
- e. Using language typical within the industry
- f. View: not only the details themselves, but how they complement each other
- g. Building of a "taste memory," a sort of mental database of sensory experiences
- h. Knowledge of how the samples will be used in the intended market
- i. Ability to apply skills depending on what is required professionally

The coffee cupper is the person who will determine what the consumer will actually experience. As a result, they are one of the most important aspects of the coffee industry. A professional cupper that can objectively analyze samples and provide what a customer desires will be an asset to any business and should be able to have a prosperous career.

Appendix III: Descriptive Cupping

From the handout for the presentation “Beyond Scoring: Descriptive Analysis Cupping and Applications” given at the SCAA conference in Seattle, April 15-18, 2005

Descriptive Cupping: Processes and Applications

Coffee is evaluated (“cupped”) professionally for many reasons. Some sensorial tests are performed to determine a relative quality based upon predefined criteria, some to determine difference or similarity of samples, and others to rank several samples in relation to each other. Most cupping forms and systems of analysis are based upon rating samples according to flavor attributes commonly found in all coffees using numerical scales. This is particularly useful in determining quality criteria for purposes of classification (“specialty” and “commercial” for instance).

Descriptive cupping goes into greater detail exploring particular flavor attributes that may be unique to the sample. The challenge of defining a coffee product in this way is that coffees from various origins are capable of a multitude of flavors.

Summary of descriptive cupping method: Descriptive cupping breaks down the stages of flavor perception into separate sessions so that cuppers can systematically evaluate a coffee. Individual flavor attributes of a product, their intensities, and the order in which they appear are examined in separate sessions using set procedures. The results from these sessions are evaluated using various statistical and mathematical methods. The test is replicated in order to ensure veracity of results.

This can be useful to the professional in many ways. Participating cuppers develop a greater understanding of the coffee samples and the process of sensorial analysis. A detailed analysis of an individual coffee can help create efficient standards of analysis. The unique attributes found can be studied in terms of the cause of those flavors (Geographic origin? Roast? Altitude?). More detailed comparisons of flavor attributes can be made between samples.

Perhaps most important, descriptive analysis can be used in combination with consumer preference testing to determine which products are most likely to be purchased. The goal of professional cupping in a business is to ultimately provide a coffee that consumers will respond to positively. Consumer testing evaluates segments of coffee consumers in terms of their preference. By having a detailed description of a coffee in combination with consumer preference knowledge, a coffee business can begin to understand what flavor qualities certain consumers desire.

Methods of Descriptive Analysis

Sensory testing is the process of putting panelists and samples together under controlled conditions. For an effective test to produce usable results, each of these aspects must be given adequate attention.

Test Design

The first stage of test design is to determine the purpose of the test. It is useful to write this down as a simple declarative sentence, such as “The purpose of this test is to determine a specific flavor profile for Fantastic Blend” or “The purpose of this test is to describe the differences between Nicaragua Nueva Segovia roasted to different degrees.” Considerations should be made as to how the information will be used. Is this meant to be a guide for the green buyer? Should it include information for those roasting or marketing the product? Is this meant to correlate with consumer perceptions or tests? These questions will determine how specific the information must be and how the samples should be prepared.

All the usual good practices for sensory testing should be included. These can be found in other literature, but in summary:

- Consistent sample preparation
- Consistently followed test protocols
- Samples disguised by 3-digit codes different for each session
- Trained panel
- Replication for statistical significance
- Valid methods of analysis

The area where the test will be held is also important. It should be clean, well-lit, free from interfering aromas or flavors, and quiet. Besides the standard cupping materials, a white board, markers, and erasers are needed.

Due to the amount of time the test takes and to keep the panel fresh, it is best not to try to cup more than two or three samples in a session. It is best to schedule the various sessions on different days, rather than consecutively on one day.

Sample Preparation

Securing or producing coffee samples for testing: The samples must be uniformly prepared for the sessions and should be as close as possible to an “ideal” or “gold standard” sample. A single representative sample from a recently produced batch from production would work. If the purpose is testing products as they would be perceived by the consumer, it is better to get a sample that is actually in the field, like a packaged sample on a retailer’s shelf.

A laboratory produced sample is not recommended unless the purpose of the test is product development and the coffee is not currently in production. Enough uniformly-

prepared coffee should be produced to get through all phases of the descriptive test. The sample should be as close to what the consumer will get as possible.

Sample preparation: The SCAA sample preparation procedures are recommended. They are detailed in other SCAA literature, but in summary they include:

- Optimum ratio 8.25 gm per 150 ml water
- Weigh whole beans (rather than grinds)
- Grind immediately prior to cupping
- Grind particle size coarser than grinding for paper filter brewing
- Clean grinder with coffee to be cupped
- Samples should be covered with lid prior to infusion
- 5 cups per sample
- Water should be clean & odor free
- Ideal Water:
 - Total Dissolved Solids (TDS) 125 – 175 ppm
 - Total alkalinity and hardness between 100 – 250 ppm
 - pH at 7.0 to 7.2
 - Freshly drawn, aerated, poured just off the boil
- Fill cup to the rim
- Steep grinds 3-5 min. before cupping

The usual procedure of first evaluating the dry grounds, then breaking the crust to evaluate the aroma, then evaluating the liquor at 2 different temperatures is followed.

Training

A trained descriptive panel can be a valuable asset for a beverage business. A panel of 6 to 12 is recommended. The goals of training a panel for descriptive analysis is to orient panelists to thinking qualitatively about the flavors they are experiencing, to express their perceptions as precisely and accurately as possible, to develop greater sensitivity, and to be motivated towards doing a good job. A well-trained panelist should be able to recognize various flavor attributes and their relative intensities while being able to communicate their experience.

A good source for training protocols is the International Standards Organization (ISO), available through the standards store at <http://www.iso.org/iso/en/prods-services/ISOstore/store.html>. Other sensory testing protocols are also available, including those for specific descriptive methods such as flavor profiling and aroma profiling.

Qualification of panelists: Due to training and personality, some individuals who are quite good cuppers do not always make the best descriptive panelist. Those who have fixed opinions about what a coffee is may not be able to think creatively enough to regard coffee from different viewpoints. Panelists should also be able to work well within a group, sharing their perceptions but not dominating.

Panelists must also be reasonably sensitive to different aspects of coffee. Qualifying sensory tests, those that test recognition of intensities of sweet, salt, sour, and other perceptions, can be used.

Training program: A standard training that will introduce the panelist to descriptive cupping and terms used should be in place so that new panelists can be trained as necessary. The use of standards, pure substances that dependably taste the same (such as sugar, salt, etc.) are useful in defining terms and developing panel recognition of flavor attributes.

Many of the SCAA training programs and materials now available are useful for this training. The “Le Nez de Café” coffee aromas are useful in developing aroma recognition and memory. The “Organic Acids” training demonstrate how various acids differ qualitatively. Tests used to qualify cuppers can be used to determine if panelists are adequately sensitive to various stimuli.

Forms for Testing

Once the sample has been produced and the panel trained, the forms should be produced. There are different forms for each stage of testing.

Panelists develop their descriptions of flavor attributes in the first stage. Depending on the desired approach, one can allow the panel to come up with their own descriptions (as in “Form 1: Free Choice Descriptive Cupping Form” at the end of this handout. Some panelists find it easier if flavor attributes are suggested, as in “Form 2: Qualitative Descriptive Scoresheet.” The intensities listed in “Form 1” are meant to indicate the general intensity of that particular set of results.

After one or two replications of the qualitative stage have been performed, the panel determines the order in which the flavor attributes occur in a separate session. The flavor attributes are listed on a new form, with a space for a number so that the order can be determined.

Once the flavors are evaluated qualitatively and order of occurrence has been determined, a form is made that will allow the panelists to evaluate the intensity of flavor attributes found. The form presented to panelists is “Form 3: Descriptive Intensities” (the “Form 4: Descriptive Intensity Measurements” is to evaluate the intensities numerically after testing).

Conducting the Test

Stage one: Term development: Panelists evaluate the samples using typical cupping methods in silence using either “Form 1” or “Form 2.” Instead of rating the samples using a scoring system, the panel comes up with various descriptions of the flavor attributes in as much detail as possible. After the session, panelists share their impressions in a group

discussion. The group discussion leader summarizes and focuses the group as they come to a consensus about the various flavor attributes of the coffee.

At least one replication of this stage should be performed and two may be necessary of a complex sample. By the end of the test, the panelists should agree that the sample is described in adequate detail.

Stage 2: Determination of order of occurrence: The attributes found are listed and the order is determined by panelists. A discussion may be held to make final determination.

Stage 3: Determination of intensities: The attributes are listed on “Form 3: Descriptive Intensities” in the order determined. Panelists mark the relative intensity of the attributes on the linear scale. These intensities are quantified using “Form 4” (this can be copied onto transparencies for easier determination).

Results of Descriptive Cupping

The intensities of flavor attributes found by the panel are averaged. Computing the standard deviations of each attribute will also reveal which are most obvious to the panel. If there is serious disagreement, the sample may be resubmitted.

The result of descriptive cupping is a detailed analysis of the individual flavor attributes of a coffee. These attributes are rated in terms of the particular aspect of sensory experience (aromatics, taste, flavor, tactile and aftertaste sensations), the intensity of the attribute, and the order in which the attribute occurs. This “flavor profile” of a sample is usually illustrated with a “radar” (also called a “spider”) diagram. This method of graphing is available in Excel. An example is shown in Figure 1.

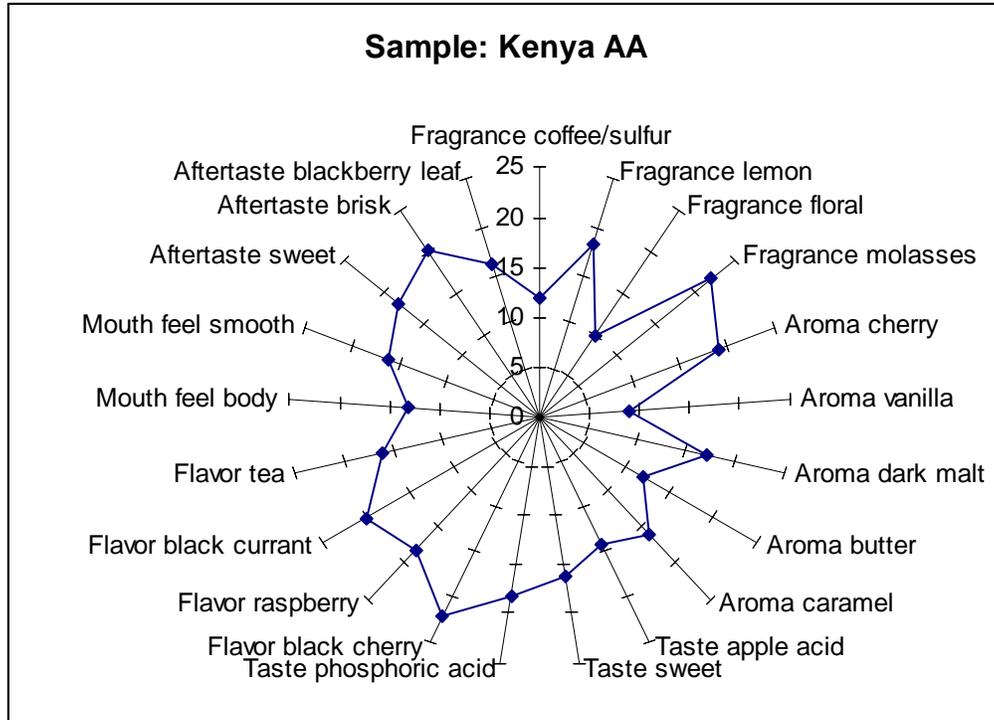


Figure 16: Flavor profile of a Kenya AA.

It is not uncommon to have 20-30 individual flavor attributes. After a detailed flavor profile has been determined, the most important flavor aspects and their intensity ranges are determined and used for quality control.

In Figure 2, some of the flavor attributes have been generalized (“red/black fruit” instead of cherry, for instance) and some eliminated that were not considered important to the quality of the product. This standard is compared to 2 samples submitted.

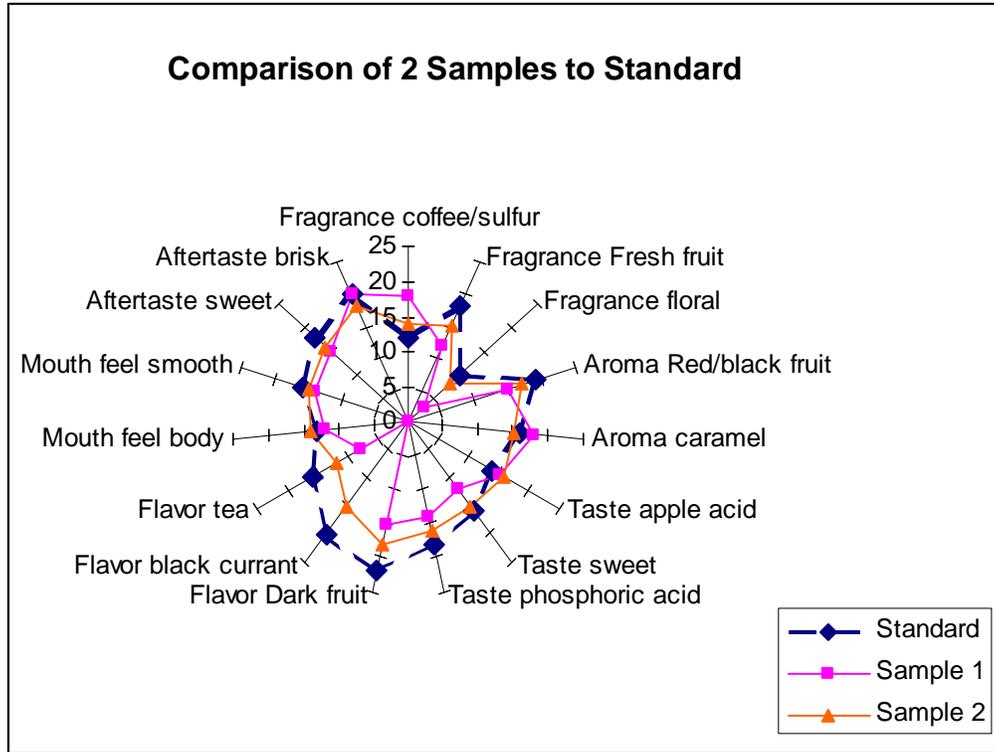


Figure 17: Comparison of standard (blue dotted line) to 2 submitted samples.

Sample 2 comes closer to meeting the standard, though sample 1 is similar in many aspects. These profiles can be used to train quality control cuppers to recognize the flavor attributes that a particular coffee must have.

Comparisons to other samples

Since the results of descriptive cupping are multi-dimensional, comparisons between coffees require more advanced statistical methods. Though these methods are complex in terms of mathematics, the resulting graphs are quite useful in observing trends and the distance between coffees.

One common method of detailing differences between samples is the Principal Component Analysis (PCA). These methods of analysis are available in various statistical programs. The data is first prepared by selecting the flavor attributes that are most important to the flavor profiles of the samples. These attributes are correlated to one another. The flavor attribute correlations are illustrated in terms of angles between the components. If the angle between attributes is small, the flavor attributes correlate (when one attribute is found, the other is found as well). If the angle between two attributes is close to 180°, the attributes have a negative correlation (when one attribute is found, the other is not found). If the angle between the 2 attributes is 90°, they have no correlation.

These correlations create a space on which the samples can be mapped as points. An example can be seen in Figure 3.

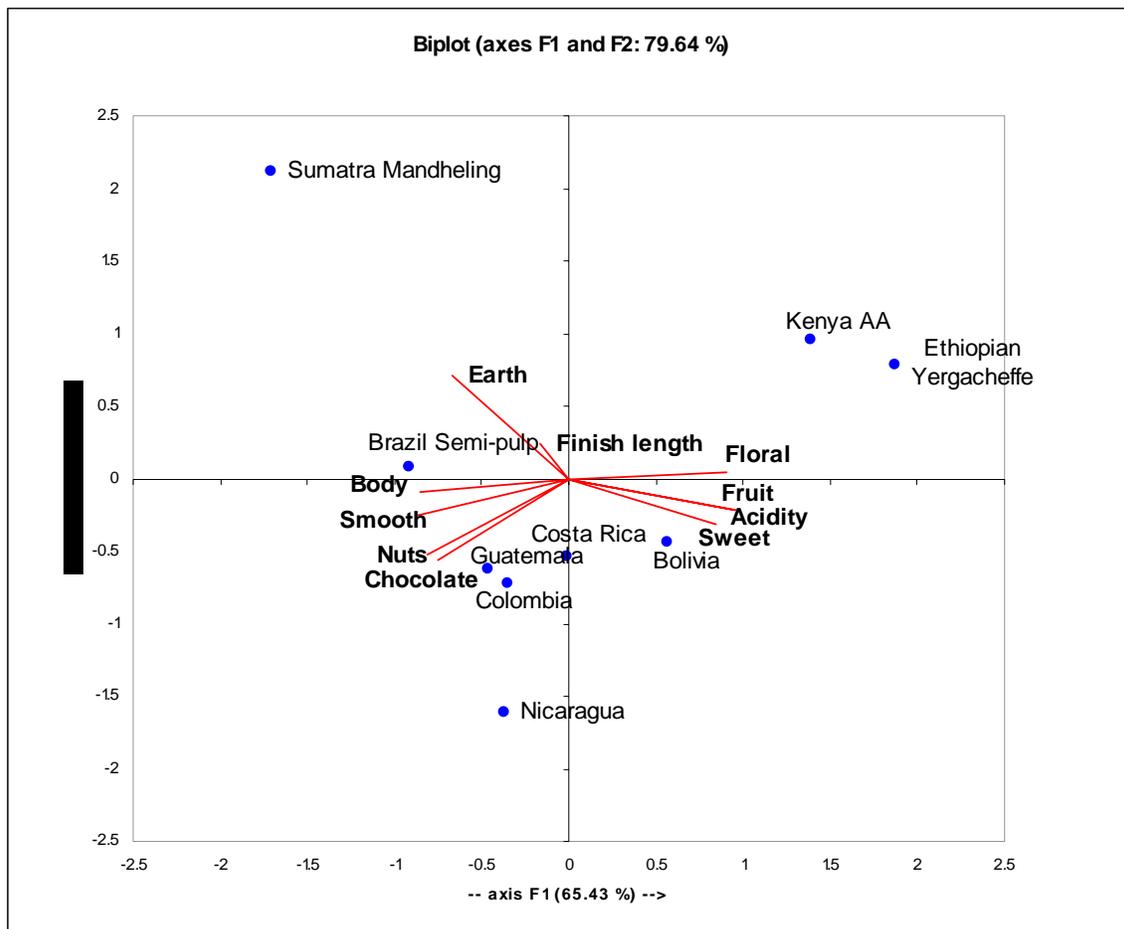


Figure 18: PCA of several samples descriptively analyzed.

Using Developed Data and Analysis

The PCA can be used to make comparisons between the samples themselves. The Ethiopian Yergacheffe and Kenyan AA samples have more in common with each other than with the Central/South American samples. The attributes themselves can also be compared. Fruit flavors and acidity correlate closely, while earthy flavor was not found in conjunction with fruit.

Other information can be integrated into the PCA, such as effects of production parameters on the flavor profile. In Figure 3, Agrtron measurements are integrated into a PCA of the same sample roasted to different degrees. This can be used to optimize the intended flavor of a coffee.

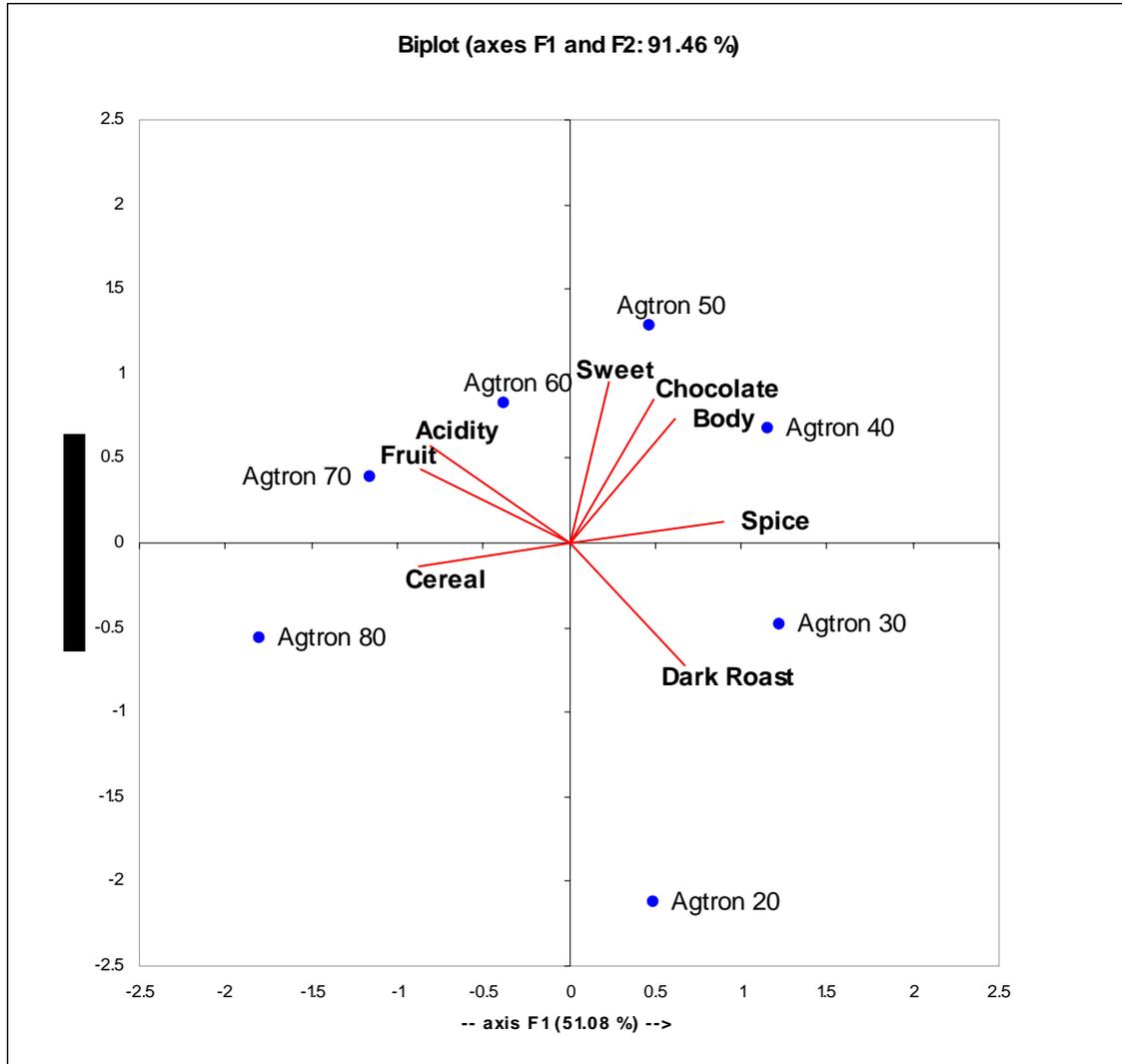


Figure 19: PCA of a single sample at different roast degrees. The coffee is roasted darker as the Agtron number decreases.

Depending on what flavor attributes the roaster wants to emphasize, the sample can be roasted darker or lighter. Seeing this visually often helps the product developer to visualize an “ideal” product that would correspond to a certain location on the PCA.

One can also integrate consumer preferences or other market information into the PCA. Figure 4 shows a roaster’s line of products (the same as shown in Figure 2) integrated with sales of those products from 4 different locations. Decisions can be made about what products to introduce or eliminate, or what to promote at different locations.

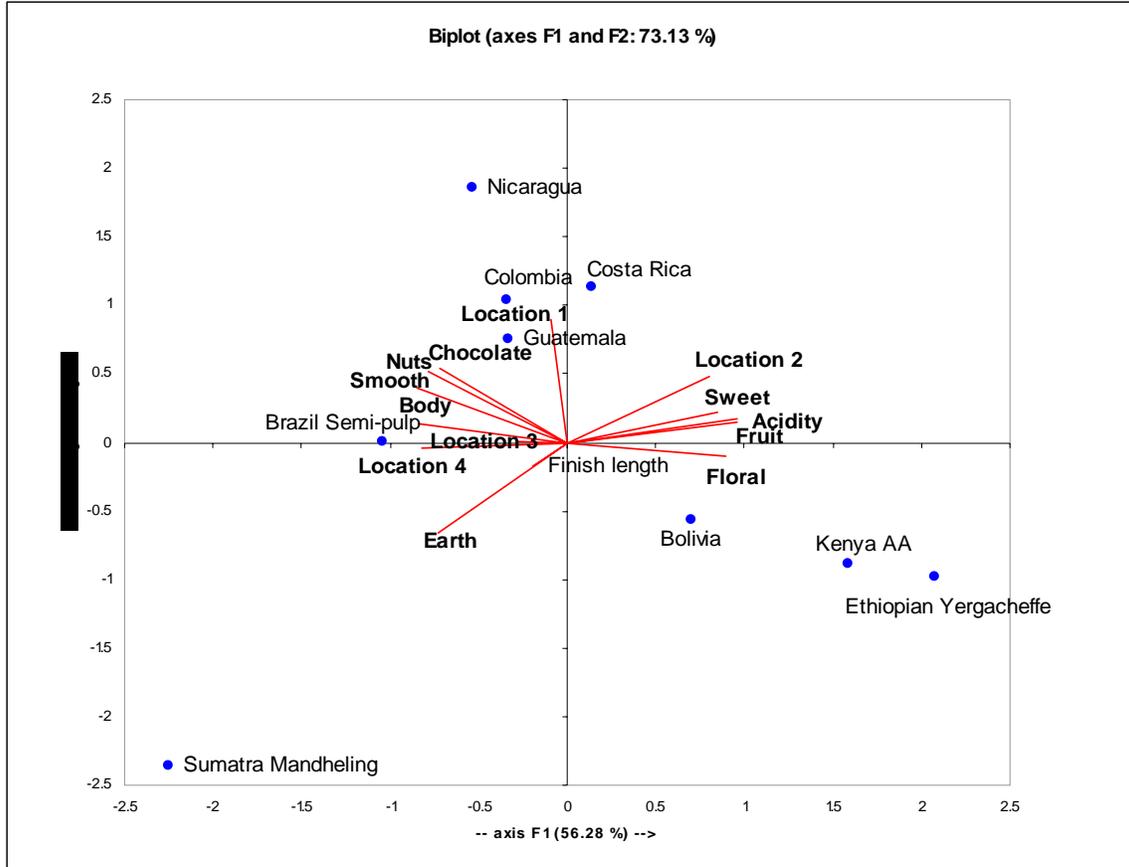


Figure 20: Flavor attributes and sales at 4 store locations.

Coffees that are more acidic and have fruit/floral/sweet profiles sell best at Location 2, Location 1 sells a larger percentage of Central and South American coffees. Customers at Locations 3 and 4 have similar preferences. This information can be used to determine what new products to introduce or promote and can be useful to profile the demographics of customers who patronize the locations to determine what will be preferred in new locations under consideration with similar demographics.

Summary

The diversity of coffee flavors creates the opportunity to sell different products to a wide variety of consumers who may have assorted preferences. Descriptive cupping can assist in this goal in many ways.

- In the roasting sector, by having a detailed analysis of flavor attributes, one can define a coffee product and the unique flavor qualities it must have. In the agricultural sector, this detailed analysis can let a grower or exporter know what they have and how it fits into what is generally available.
- Those coffee flavor attributes can be optimized by exploring how various production aspects affect flavor. One can quantify flavor attributes in terms of roast parameters, agricultural inputs, growing locations and conditions, processing parameters, presence of certain chemicals, and many other technical aspects.
- In conjunction with consumer testing and demographic/geographic analysis, the consumer segment most likely to prefer the coffee can be identified. Certain coffees and blends can be developed that appeal to certain segments. The likelihood of a coffee succeeding in the marketplace can be analyzed.

The primary disadvantage of descriptive sensory analysis is the time that is taken. The testing itself is time consuming and it takes time to train the panel. However, a well-trained panel can develop detailed knowledge about coffees and that information properly applied can develop a profitable business.

Form 1: Free Choice Descriptive Cupping Form

Fragrance

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Aroma

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Taste

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Flavor

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Mouth feel

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Finish

| | | | |
|-------|-------|-------|-----------|
| _____ | _____ | _____ | Intensity |
| _____ | _____ | _____ | High ____ |
| _____ | _____ | _____ | Medium __ |
| _____ | _____ | _____ | Low ____ |

Form 2: Qualitative Descriptive Scoresheet

Fragrance

| | | | |
|--|---|---|--|
| <input type="checkbox"/> Floral | <input type="checkbox"/> Jasmine | <input type="checkbox"/> Chocolate | <input type="checkbox"/> Sweet, milk |
| | <input type="checkbox"/> Wintergreen, minty | <input checked="" type="checkbox"/> | <input type="checkbox"/> Dutch, alkaline |
| | <input type="checkbox"/> Rose | | <input type="checkbox"/> Baker's |
| | <input type="checkbox"/> Hibiscus | | <input type="checkbox"/> Dark |
| <input type="checkbox"/> Fruit | <input type="checkbox"/> Citrus | <input type="checkbox"/> Earthy | <input type="checkbox"/> Peat moss |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Lemon | <input checked="" type="checkbox"/> | <input type="checkbox"/> Groundy, dirty |
| | <input type="checkbox"/> Tangerine | | <input type="checkbox"/> Mushrooms |
| | <input type="checkbox"/> Grapefruit | | <input type="checkbox"/> Dusty |
| | <input type="checkbox"/> Raspberry | <input type="checkbox"/> Moldy | <input type="checkbox"/> Mildew |
| | <input type="checkbox"/> Blackberry | | <input type="checkbox"/> Harsh |
| | <input type="checkbox"/> Blueberry | | <input type="checkbox"/> Musty |
| | <input type="checkbox"/> Red | | <input type="checkbox"/> Buggy |
| | <input type="checkbox"/> Green | <input type="checkbox"/> Roasted | <input type="checkbox"/> Baked |
| | <input type="checkbox"/> Cherry | | <input type="checkbox"/> Roast beef |
| | <input type="checkbox"/> Apricot | | <input type="checkbox"/> Biscuity |
| | <input type="checkbox"/> Peach | | <input type="checkbox"/> Coffee/sulfur |
| | <input type="checkbox"/> Grape | | <input type="checkbox"/> Skunky |
| <input type="checkbox"/> Herbal, vegetal | <input type="checkbox"/> Grassy | <input type="checkbox"/> Woody | <input type="checkbox"/> Dried leaves |
| | <input type="checkbox"/> Cabbage | | <input type="checkbox"/> Paper |
| | <input type="checkbox"/> Peasy | | <input type="checkbox"/> Cardboard |
| | <input type="checkbox"/> Onion | | <input type="checkbox"/> Hay, straw |
| | <input type="checkbox"/> Garlic | | <input type="checkbox"/> Cedar |
| | <input type="checkbox"/> Bell pepper | <input type="checkbox"/> Sour | <input type="checkbox"/> Acerbic |
| <input type="checkbox"/> Nuts | <input type="checkbox"/> Peanut | | <input type="checkbox"/> Fermented |
| | <input type="checkbox"/> Almond | | <input type="checkbox"/> Cheesy |
| | <input type="checkbox"/> Hazelnut | <input type="checkbox"/> Resinous, solvent-like | <input type="checkbox"/> Turpeny |
| | <input type="checkbox"/> Walnut | | <input type="checkbox"/> Medicinal |
| <input type="checkbox"/> Cereal | <input type="checkbox"/> Corn | | <input type="checkbox"/> Alcohol |
| | <input type="checkbox"/> Barley | | <input type="checkbox"/> Petroleum |
| | <input type="checkbox"/> Dark Rye | <input type="checkbox"/> Spicy | <input type="checkbox"/> Black Pepper |
| <input type="checkbox"/> Caramel, sugar browning | <input type="checkbox"/> Caramel | | <input type="checkbox"/> Clove |
| | <input type="checkbox"/> Molasses | | <input type="checkbox"/> Nutmeg |
| | <input type="checkbox"/> Toffee | | <input type="checkbox"/> Cinnamon |
| | <input type="checkbox"/> Praline | | <input type="checkbox"/> Anise |
| | <input type="checkbox"/> Malt | <input type="checkbox"/> Carbon | <input type="checkbox"/> Tar |
| <input type="checkbox"/> Sweet | <input type="checkbox"/> Honey | | <input type="checkbox"/> Ash |
| | <input type="checkbox"/> Vanilla | | <input type="checkbox"/> Burnt |
| | <input type="checkbox"/> Custard | | <input type="checkbox"/> Charred |
| <input type="checkbox"/> Animal | <input type="checkbox"/> Barnyard | | |
| | <input type="checkbox"/> Sweaty | | |
| | <input type="checkbox"/> Leathery | | |

Aroma

| | | |
|--|---|---|
| <input type="checkbox"/> Floral | <input type="checkbox"/> Jasmine | <input type="checkbox"/> Sweet, milk |
| | <input type="checkbox"/> Wintergreen, minty | <input type="checkbox"/> Dutch, alkaline |
| | <input type="checkbox"/> Rose | <input type="checkbox"/> Baker's |
| | <input type="checkbox"/> Hibiscus | <input type="checkbox"/> Dark |
| <input type="checkbox"/> Fruit | <input type="checkbox"/> Citrus | <input type="checkbox"/> Earthy |
| | <input type="checkbox"/> Lemon | <input type="checkbox"/> Peat moss |
| | <input type="checkbox"/> Tangerine | <input type="checkbox"/> Groundy, dirty |
| | <input type="checkbox"/> Grapefruit | <input type="checkbox"/> Mushrooms |
| | <input type="checkbox"/> Raspberry | <input type="checkbox"/> Dusty |
| | <input type="checkbox"/> Blackberry | <input type="checkbox"/> Moldy |
| | <input type="checkbox"/> Blueberry | <input type="checkbox"/> Mildew |
| | <input type="checkbox"/> Red | <input type="checkbox"/> Harsh |
| | <input type="checkbox"/> Green | <input type="checkbox"/> Musty |
| | <input type="checkbox"/> Cherry | <input type="checkbox"/> Baggy |
| | <input type="checkbox"/> Apricot | <input type="checkbox"/> Roasted |
| | <input type="checkbox"/> Peach | <input type="checkbox"/> Baked |
| | <input type="checkbox"/> Grape | <input type="checkbox"/> Roast beef |
| <input type="checkbox"/> Herbal, vegetal | <input type="checkbox"/> Grassy | <input type="checkbox"/> Biscuity |
| | <input type="checkbox"/> Cabbage | <input type="checkbox"/> Coffee/sulfur |
| | <input type="checkbox"/> Peasy | <input type="checkbox"/> Skunky |
| | <input type="checkbox"/> Onion | <input type="checkbox"/> Woody |
| | <input type="checkbox"/> Garlic | <input type="checkbox"/> Dried leaves |
| | <input type="checkbox"/> Bell pepper | <input type="checkbox"/> Paper |
| <input type="checkbox"/> Nuts | <input type="checkbox"/> Peanut | <input type="checkbox"/> Cardboard |
| | <input type="checkbox"/> Almond | <input type="checkbox"/> Cedar |
| | <input type="checkbox"/> Hazelnut | <input type="checkbox"/> Hay |
| | <input type="checkbox"/> Walnut | <input type="checkbox"/> Sour |
| <input type="checkbox"/> Cereal | <input type="checkbox"/> Corn | <input type="checkbox"/> Acerbic |
| | <input type="checkbox"/> Barley | <input type="checkbox"/> Fermented |
| | <input type="checkbox"/> Dark Rye | <input type="checkbox"/> Cheesy |
| <input type="checkbox"/> Caramel, sugar browning | <input type="checkbox"/> Caramel | <input type="checkbox"/> Resinous, solvent-like |
| | <input type="checkbox"/> Molasses | <input type="checkbox"/> Turpeny |
| | <input type="checkbox"/> Toffee | <input type="checkbox"/> Medicinal |
| | <input type="checkbox"/> Praline | <input type="checkbox"/> Alcohol |
| | <input type="checkbox"/> Malt | <input type="checkbox"/> Petroleum |
| <input type="checkbox"/> Sweet | <input type="checkbox"/> Honey | <input type="checkbox"/> Spicy |
| | <input type="checkbox"/> Vanilla | <input type="checkbox"/> Black Pepper |
| | <input type="checkbox"/> Custard | <input type="checkbox"/> Clove |
| <input type="checkbox"/> Animal | <input type="checkbox"/> Barnyard | <input type="checkbox"/> Nutmeg |
| | <input type="checkbox"/> Sweaty | <input type="checkbox"/> Cinnamon |
| | <input type="checkbox"/> Leathery | <input type="checkbox"/> Anise |
| | | <input type="checkbox"/> Carbon |
| | | <input type="checkbox"/> Tar |
| | | <input type="checkbox"/> Ash |
| | | <input type="checkbox"/> Burnt |
| | | <input type="checkbox"/> Charred |

Liquor

Gustation

| | | | |
|----------------------------------|------------------------------------|---------------------------------|-----------------------------------|
| <input type="checkbox"/> Acidity | <input type="checkbox"/> Mellow | <input type="checkbox"/> Sweet | <input type="checkbox"/> Ripe |
| | <input type="checkbox"/> Tart | | <input type="checkbox"/> Mild |
| | <input type="checkbox"/> Tangy | <input type="checkbox"/> Rough | <input type="checkbox"/> Soft |
| | <input type="checkbox"/> Winey | | <input type="checkbox"/> Neutral |
| | <input type="checkbox"/> Fruity | <input type="checkbox"/> Bitter | <input type="checkbox"/> Briney |
| | <input type="checkbox"/> Sour | | <input type="checkbox"/> Alkaline |
| | <input type="checkbox"/> Fermented | | <input type="checkbox"/> Caustic |
| | | | <input type="checkbox"/> Creosote |

Flavor

| | |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Mouth feel

| | | |
|---|-----------------------------------|-------|
| <input type="checkbox"/> Body (viscosity) | <input type="checkbox"/> Watery | _____ |
| | <input type="checkbox"/> Viscous | |
| | <input type="checkbox"/> Syrupy | |
| <input type="checkbox"/> Smoothness | <input type="checkbox"/> Oily | _____ |
| | <input type="checkbox"/> Smooth | |
| | <input type="checkbox"/> Granular | |
| <input type="checkbox"/> Astringent | | _____ |

Finish

| | | |
|--|---------------------------------|-------------------------------|
| <input type="checkbox"/> Lingering flavors | <input type="checkbox"/> Sweet | _____ |
| | <input type="checkbox"/> Sour | |
| | <input type="checkbox"/> Rough | _____ |
| | <input type="checkbox"/> Bitter | |
| <input type="checkbox"/> Drying | | _____ |
| <i>Length</i> | | |
| <input type="checkbox"/> Short | <input type="checkbox"/> Medium | <input type="checkbox"/> Long |

Form 3: Descriptive Intensities

Form 3: Descriptive Intensities consists of 12 identical horizontal scales. Each scale is a horizontal line with three vertical tick marks labeled 'Low', 'Moderate', and 'Strong' from left to right. Above each scale, a horizontal line is drawn, and a vertical tick mark is placed on the scale line to indicate the intensity level. The scales are arranged vertically, one below the other.

Form 4: Descriptive Intensity Measurements Overlay

