A Demonstration of the Reverse Louche

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Abstract

The possibility of a "reverse louche" has been well-established in theory for some time, but a real world demonstration has proved elusive. A recent series of experiments has finally laid the question to rest by providing conclusive evidence. Not only is a reverse louche possible, it is actually perceptible to the naked eye.

I. Introduction

The *louche* is a distinctive feature of the preparation and consumption of absinthe. The spirit is usually mixed with cold water in the 3x-4x range due to its high proof. This process is classically achieved by means of a dedicated absinthe fountain which provide spigots for 2-4 people, though this is not strictly necessary. As the concentration of ethanol drops, naturally occurring hydrophobic oils in the spirit fall out of solution. This creates a stable emulsion with a droplet size of roughly one micron. On a macroscopic scale this results in the drink becoming cloudy, a process which is often enjoyed for its visual aesthetics.

Similar emulsions can be found in other beverages. Brominated vegetable oil (BVO) is used in many sodas, where it provides a stable emulsion to carry citrus flavors. This is particularly noticeable in Mountain Dew (MD), where the characteristic emulsion cloudiness is visible. In effect, MD comes with a louche already developed. Theoretically, therefore, it should be possible to reverse this process by adding ethanol, dissolving the BVO and making the soda more transparent.

This possibility has been known for some time, but previous attempts at demonstrating it have failed. The problem was in distinguishing between the increased transparency from a reverse louche process, and the increased transparency caused by simple dilution.

Figure 1: *Experimental setup*

In this paper we demonstrate a process which conclusively shows the existence of a reverse louche.

II. Methods

Because the differences between a reverse louche and a simple dilution were known to be subtle, this round of experiments made use of an electronic light transmissivity meter. This device, the WTM-1100, measures the percent of 550 nanometer light being sent from one probe that is received in the other. It has a nominal error of under 2%, which was confirmed using the $15.1\% \pm 1$ tinted plastic card which was

included with the unit.

A flat-sided vessel was used to hold the liquids, in order to reduce refractive effects on the transmissivity readings. The experimental setup is shown in figure 1. When the vessel was empty this gave a reading of 78.4%, filled with water 88.4% and with ethanol 86.1%, showing that the refractive effects were still significant even with the flat sides. The readings were repeatable to within the claimed 2%, however, so we felt confident proceeding.

The experiment consisted of three stages. First, a classic absinthe+water louche was performed, in order to properly characterize the effect. Next, a MD dilution was performed using water. Finally, a MD reverse louche with food-grade ethanol (Everclear) was attempted. By comparing the transmissivity of the MD+water and MD+ethanol at equal stages, it was hoped that the effects of dissolving the BVO could be made clear.

All experiments started with 75 mL of the base liquid (absinthe or MD). The additive was introduced in 5 mL increments, stirred thoroughly, and a transmissivity reading was taken.

It was found that the bubbles in fresh MD interfered with the transmissivity readings, so samples were left out to "go flat", and the experiments were run only using MD in that state.

The WTM-1100 unit would power itself off after several minutes, at which point a complete calibration cycle had to be repeated. Calibration was also performed at other points in the experiments when the readings became unreliable. This consisted of attaching the probes to each other so that 100% of the light was guaranteed to be received and pushing the 'CAL' button. For added confidence, the new calibration was always tested against the reference tinted plastic card to confirm the readings were within $\pm 1\%$.

III. Results

The first experiment showing a classic absinthe+water louche followed the overall pattern that was expected. 2 Transmissivity was initially around 50%, which then started to drop after 30 mL of water had been added. This hit 0% transmission at 65 mL and holds there until over 300 mL. At that point the dilution effect overwhelms the louche and transmission slowly starts to rise again.

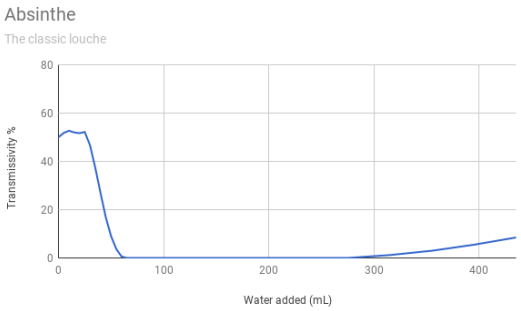

Figure 2: *Absinthe results*

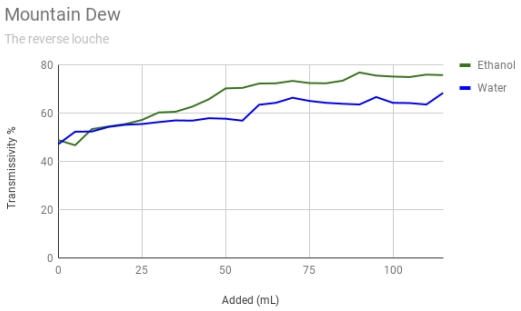

Figure 3: *Mountain Dew results*

Because so much water had to be added in order to show the return to transmission, the sample container was not large enough for the entire experiment. Half of the sample was discarded after 115 mL had been added. The additions were also increased to 10 ml as it was obvious the dilution point was still nowhere close. The sample was again halved after another 70 ml had been added. The effects of both the halving and the increased addition rates have been normalized in the graph.

With the classic louche characterized, the experiment moved on to testing with MD. This was first done using water, in order to determine how great of an effect pure dilution had

on the transmissivity. With that complete, this was repeated using ethanol. As can be seen in 3, both runs follow a similar trajectory, but the MD+ethanol run is clearly more transparent than the MD+water run. The difference between the two runs grows to around 10% by the time 50 mL had been added, holding fairly constant after that.

Several of the researchers present at the time believed they could see the difference between the water and ethanol runs. Subjective reports like this are not always to be trusted, but the data supports the claim in this case. During the preliminary absinthe+water run, the louche was noted as visibly starting to form when the transmissivity had dropped from $\approx$ 52% to $\approx$ 47%, for a difference of only $\approx$ 5%. This is considerably less than the difference seen between MD runs. There is no reason to doubt that the reverse louche is visible to the naked eye.

IV. Discussion

This paper provides strong evidence for the existence of a reverse louche. That was entirely in line with theory, but the magnitude of the effect is a matter of some surprise. While subtle, it was still detectable without the need of augmenting human senses e.g. with the use of electronic transmissivity meters. This neatly demonstrates shows how little we still know about the physical properties of the very substances upon which we rely for sustenance and life.

With the advent of "molecular gastronomy", the vast store of scientific techniques have finally started to be applied to food in a non-industrial setting. The authors feel this is well past time, as a kitchen is nothing more than a chemistry lab in which we happen to store and prepare food. It is hoped that the results in this paper will spur research in other areas of esoteric beverage science.