Wine is related to many traditions in all civilizations and cultures that originated in the Mediterranean basin, finally being directly included in the rites of the Christian and Jewish religions. But it is unclear if the concept of wine of 2,000 years ago was the same as the one we know today. In fact, reading the Greek texts, we find “recipes” that leave us somewhat perplexed. For example Circe, to stordire i compagni di Ulisse,

...made for them a potion of cheese and barley meal and yellow honey with Pramnian wine. [1]

To date, the Greek resinous wine, for me at least, can serve so many purposes, but not that of drinking. However, in Greece wine were always supplemented with water, in special containers called crateri [2]. Normally the dilution were one part wine to three parts water, but it could go as high as one to ten when it was necessary to remain lucid. Drinking pure wine was a barbaric habit, leading to catastrophe (Polyphemus indeed had his eye burned for this).
Wine is an essential component of almost all public rituals, especially wedding receptions. At Cana, if Jesus hadn’t been there to help turn water into wine, the wedding would certainly not have been a success. Obviously, an ever effective way to increase the amount of wine is to mix it with water. I suspect that John wanted to totally dismiss this suspicion when he emphasized how:

… the master of the banquet tasted the water that had been turned into wine. He did not realize where it had come from, though the servants who had drawn the water knew. Then he called the bridegroom aside and said, “Everyone brings out the choice wine first and then the cheaper wine after the guests have had too much to drink; but you have saved the best till now.”[3].

Let us focus on the act of mixing wine and water. It seems to be a simple and natural task, yet it may hide some surprises.

The fundamental question is: how difficult is it to mix water and wine? At first sight it is not clear why they should not mix, since wine is essentially composed 70-90% of water and then 9-16% of alcohol, and the latter dissolves easily in water (so easily that the pure alcohol, obtained by distillation, contains at least 5% water, which must be eventually eliminated by chemical means).

So we have the chance to impress our fellow drinkers during, for example, a long wedding banquet, by preparing a glass in which water and wine (preferably red, because it is more visible) remain separate. To do that, fill half a glass with water, preferably cold, then lay a piece of plastic or paper on the surface of the liquid and then slowly pour the wine. Once the paper or plastic is removed carefully, we may see that the two liquids do not mix (Figure 1).
of plastic or paper (or even a towel) on the surface of the liquid and slowly pour the wine. Then gently remove the separation sheet. Everyone can see that the two liquids do not mix (Figure 1).

Water and wine can remain separate for a rather long time (a few days), especially at low temperature. If one wants to increase the separation, in addition to playing with the difference in the temperature, it is possible to add salt to the water, so as to increase its density.

This effect is also the basis of another apparent paradox. We know that salt, by lowering the melting point of ice, favours its dissolution. So we can expect an ice cube placed in a glass of wine with salt to melt before an equal cube put in a glass of standard wine. However, when we do the experiment, we observe the opposite phenomenon (Figure 2).

Again, the explanation has to do with the stratification of liquids. Standard wine (or fresh water) is lighter than the salted version, but cold liquids are heavier than those at room temperature (the maximum density for water is at about 4 degrees). As can be seen for water in Figure 3, the variation of density for salinity easily beats that due to temperature.

So the melting water of the ice cube in the glass of standard wine at room temperature tends to fall downward, leaving the same cube surrounded by the warm liquid and therefore with a higher melting rate. Conversely, in the glass with salt wine, the fusion water, although cold, is lighter than the salt liquid and therefore floats. The ice cube is thus surrounded by cold fresh water and melts more slowly. Holding the glass with the wine but without the salt to the light, one can see a plume of cold water flowing down from the cube. The phenomenon can be highlighted by using a dyed ice cube and normal water, with and without salt. In the glass

Figura 1. Acqua e vino restano separati per lungo tempo. Immagine dell’autore.
Figure 1. Water and wine remain separate for a long time. Image by the author.
L’acqua e il vino possono restare separati per un tempo piuttosto lungo (qualche giorno), soprattutto se la temperatura è bassa. Se si vuole rendere più evidente la separazione, oltre a giocare sulle differenze di temperatura, si può aggiungere del sale all’acqua in modo da aumentarne la densità.

Questo effetto è anche alla base di un altro apparente paradosso. Sappiamo che il sale, abbassando la temperatura di fusione del ghiaccio, favorisce il suo scioglimento. Quindi ci aspettiamo che un cubetto di ghiaccio si scioglia prima se messo in un bicchiere di vino con del sale, rispetto ad un uguale cubetto messo in un bicchiere di vino senza sale. Invece, se si effettua l’esperimento, si osserva il fenomeno opposto (Figura 2).

La spiegazione ha di nuovo a che fare con la stratificazione dell’acqua. L’acqua dolce o il vino sono più leggeri delle loro controparti salate, ma i liquidi freddi sono più pesanti di quelli a temperatura ambiente (il massimo di densità per l’acqua è intorno ai 4 gradi). Come si vede in Figura 3 per l’acqua, la variazione di densità dovuta alla salinità batte facilmente quella dovuta alla temperatura.

Quindi, l’acqua di fusione del cubetto di ghiaccio nel bicchiere con il vino a temperatura ambiente tende a cadere verso il basso, lasciando il cubetto stesso circondato dal liquido tiepido e quindi con un tasso di fusione alto. Viceversa, nel bicchiere con vino salato, l’acqua di fusione, anche se fredda, è più leggera e quindi galleggia. Il cubetto di ghiaccio si trova così circondato da un liquido più freddo del caso precedente e si scioglie più lentamente. Guardando il bicchiere con il vino senza sale in controluce si vede la “piuma” di acqua fredda che scende giù dal cubetto. Questo fenomeno si può mettere in evidenza mettendo un cubetto

![Figura 2. Il ghiaccio nel vino con il sale si scioglie più lentamente. Immagine dell’autore.](image_url)

*Figure 2. The ice in wine with salt dissolves more slowly. Image by the author.*
with the salt one can see the layer of the dyed fusion water floating above the rest of the liquid (Figure 4).

We said that salt melts ice. However, it is not generally clear that when this happens the temperature of the mixture decreases, since energy is needed to melt the ice. One can exploit this effect to amaze bystanders with another challenge: how to grab an ice cube floating on water using a cotton sewing thread. All attempts to capture the cube with a “lasso” will fail. Rather, just wet the thread in the water, place it on the cube and sprinkle it with salt. The ice melts, greatly lowering the temperature below zero, so that the fresh water soaking the thread freezes, merging with the ice, and allowing the capture of the cube (Figure 5) [5].

Finally, as an act of supreme virtuosity, one can show that he/she can exchange the contents of a glass containing water with one containing wine, without using a third vessel. It is better to use small glasses, like those for liquors, which must be filled to the brim.

The trick is to bring the two liquids, which have different densities (which can be increased by using cold salted water and wine at room temperature), into contact. But we must keep the flow laminar, since turbulence promotes mixing.

We can place a credit card under part of the base of the glass containing wine to slightly incline it (so to break the symmetry). With another credit card we can seal the water glass before turning it upside down and placing it above the one containing wine. The separation card must be positioned perpendicularly (that is, with respect to its long sides) to the one under the wine glass. One then gently moves the card separating the liquids so as to open a passage.
Figura 4. Cubetto di ghiaccio colorato fuso in acqua con e senza sale. Nel bicchiere con il sale si vede lo strato di acqua di fusione colorata galleggiare sopra il resto del liquido (Figura 4).

Abbiamo detto che il sale fa sciogliere il ghiaccio. Non è però chiaro a tutti che, quando questo accade, la temperatura della miscela si abbassa, perché per fondere il ghiaccio c’è comunque bisogno di energia. Possiamo sfruttare questo effetto per esibirci con un altra sfida: afferrare un cubetto di ghiaccio che galleggia sull’acqua usando un filo di cotone, di quelli da cucito. Tutti i tentativi di prendere il cubetto con un “lazo” falliranno. Viceversa, basta bagnare il filo nell’acqua, appoggiarlo sul cubetto e spargervi sopra del sale. Il ghiaccio fonde, portando la temperatura abbondantemente sotto lo zero. In questo modo, l’acqua (dolce) che circonda il filo congela, si fonde con il ghiaccio e ne permette quindi la cattura (Figura 5) [5].

Infine, come supremo virtuosismo, facciamo vedere che possiamo scambiare il contenuto di un bicchiere contenente acqua e di uno contenente vino, senza usare un terzo recipiente. Conviene usare dei bicchierini piccoli, tipo quelli da liquore, che devono essere pieni fino all’orlo.

Il trucco è quello di mettere in contatto i due liquidi, che hanno densità differente (e conviene aumentare questa differenza usando acqua fredda salata e vino a temperatura ambiente). Bisogna però limitare il flusso per tenerlo laminare, dato che la turbolenza favorisce il mescolamento.

Si usa quindi una carta di credito per tenere inclinato il bicchierino contenente il vino, e con un’altra carta di credito si copre il bicchiere dell’acqua e lo si ribalta sopra quello del vino. La carta di separazione deve essere posizionata perpendicolarmenete (considerando i lati lunghi) rispetto a quella sotto il bicchiere del vi-
Figura 5. Cattura del cubetto di ghiaccio con del filo da cucito. Si bagna il filo e lo si dispone sul cubetto, quindi si cosparge di sale. Dopo un minuto si può sollevare il cubetto. Immagine dell’autore.

Figure 5. Capture of the ice cube with the sewing thread. Wet the thread and place it on the cube, then sprinkle it with salt. After a minute you can pick up the cube. Image by the author.


Figure 6. Water and wine exchange. Image by the author.
The liquids do not pour out of the small opening between the glasses as a result of the surface tension and the internal depression. If all goes well, one can see a “plume” of red wine climbing up, and one of water flowing down. The exchange will continue up to the point at which the two liquids have swapped in an almost perfect manner (Figure 6) [6].

At this point one can go around to the diners and collect the inevitable tips ...

A Spanish version of this article appeared in Revista C2 [7]

References

[1] Homer, Odyssey, X, 233-234. A similar recipe can be found in the Iliad, XI, 856-863: “In this the woman, as fair as a goddess, mixed them a mess with Pramnian wine; she grated goat’s milk cheese into it with a bronze krater, threw in a handful of white barley-meal, and having thus prepared the mess she bade them drink it.”