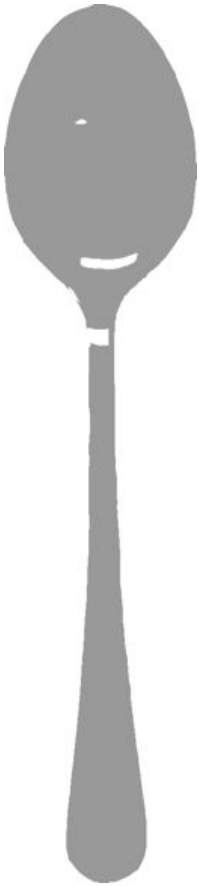
The Taste of Materials

_spoons



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Introduction

Over the past three years we have been investigating some of the science behind the taste of inanimate *stuff*. Our aim was to look at the relationship between materials, objects, form and function, from the point of view of the art, science, craft, design and engineering of materials. The majority of our subsequent taste related research focused on a range of tea spoons made from varying metals that we used to conducted a series of experiments to find out how they tasted, why this was so, and what effect this might have on food.

Tonight we wish to share some of our findings and provide you with a chance to dine with our specially created spoons. We hope that you will enjoy this experience and begin to appreciate why materials matter.

The Taste of Materials

Many different materials come into contact with our food and taste buds every day. Wooden spoons, aluminium pots, copper pans, stainless steel forks, ceramic cups and plastic bottles, each with their own specific forms, function and effects on our experience of consuming food and drink. In this project we asked ourselves how do these materials taste, do they affect the taste of food, and is it possible to understand, and thus design, the affect they have?

Tastes are received through our taste buds, which are located on the upper surface of the tongue. There are five basic tastes: bitter, salty, sour, sweet, and umami. These formal tastes are not the only component of the sensations associated with the overall experience of flavour. Other important factors include smell, detected by the olfactory system, texture detected by mechanoreceptors, and temperature, detected by thermoreceptors.

The perception of flavour in relation to the cutlery used to eat the food is less appreciated and understood. In our research project we set out to perform a systematic investigation of the relation between perceived taste and the physical or chemical properties of cutlery material. In other words we set out to determine how the tastiness of a spoon affects the food that is eaten from it, and how the taste of materials affects the experience and perception of them.

In order to conduct experiments into the taste of materials, we made a set of seven spoons of different metals that served as both the scientific experimental equipment and culinary curiosity. In the first study, volunteers were recruited from a broad section of the general public and, in controlled conditions, asked to rate the taste of the spoons in relation to how cool, hard, salty, bitter, metallic, strong, sweet and unpleasant they perceived them to be. In the second study, volunteers were asked to rate the taste of sweet, sour, salty, plain and bitter flavoured creams, eating using the spoons.

We found firstly that people are very sensitive to different metals and can distinguish between them. Secondly, that these taste sensations correlate with the standard electrode potential of the metal, suggesting that it may be possible to design the taste of metals through alloying. Thirdly, that the taste of spoons made from certain metals does influence the perception of the flavour of the food, such as its sweetness, bitterness and indeed pleasantness, opening up the possibility of designing certain dishes for particular metal spoons.

The Research

To date, our systematic investigations into the relationship between the perceived taste and the physical properties of materials have resulted in the publication of two research papers in the journal Food Quality & Preference. Both papers have the use of our seven metallic teaspoons at the heart of their methodology. The summaries of the two papers are provided below and the full texts are provided in the accompanying A4 envelope marked 'Research'.

Paper 1

The use of standard electrode potentials to predict the taste of solid metals

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Abstract:
Not all metals taste equally metallic when placed in the mouth. While much work has been done to examine the metallic taste sensations arising from metal ions in solutions, there is comparatively less known about the taste of solid metals. In this study seven metals in the form of spoons were used to compare the perception of taste arising from solid utensils placed inside the mouth. Thirty-two participants tasted seven spoons of identical dimensions plated with each of the following metals: gold, silver, zinc, copper, tin, chrome and stainless steel. More negative standard electrode potentials were found to be good predictors of solid metals that had tastes scoring highest for the taste descriptors strong, bitter and metallic. Thus, it was found that both gold and chrome (having the most positive standard electrode potentials) were considered the least metallic, least bitter and least strong tasting of the spoons. Zinc and copper (having the most negative standard electrode potentials) were the strongest, most metallic, most bitter, and least sweet tasting of the spoons. We conclude that gold and chrome have tastes that are less strong than metals with lower standard electrode potentials.

Paper 2

Tasting spoons: Assessing how the material of a spoon affects the taste of the food

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Abstract:
This study investigated the effect that the taste of certain metals has on the perception of food. Four spoons plated with different metals (gold, copper, zinc, and stainless steel) were used to taste cream samples having different tastes: sweet, sour, bitter, salty, and plain. The results revealed that the zinc and copper spoons, in addition to transferring a somewhat metallic and bitter taste, enhanced to a greater or lesser extent, each cream's dominant taste. Contrary to our expectations, the metallic taste of the copper and zinc spoons did not seem to affect the pleasantness of the samples significantly. These findings reveal that the effect that the metals from which cutlery can be made have on food perception differs from that found when the metal salts are added to the composition of the food itself.

The Spoons

Element Symbol:	Cu	Au	Ag
Materials Name:	copper	gold	silver
Taste Notes:	• strongly metallic • bitter • good thermal conductivity • cools the heat of chilli and accentuates spices • found to slightly inhibit saltiness • astringent in acidic foods • unpleasant in some situations	• soft sweetness • highly pleasant • smooth, almost creamy • harmonious • does not react with acidic foods	• slight bitterness • occasionally unpleasant • unbalances specific dishes • a little harsh with sweet dishes

Sn

Tin

• occasionally slightly bitter
• has been found to add depth to specific dishes

Zn

Zinc

• strongly metallic
• bitter
• found to slightly inhibit saltiness
• Earthy, dry, rasping tendency that increases when oxidised

Cr

Chrome

• highly pleasant
• neutral
• smooth
• occasionally adds depth to flavours

Stainless Steel

• neutral
• the most pervasive material for cutlery manufacturing
• familiar

NB: Please feel free to add your own observations to this page or in the notes section on page 9. One of the purposes of this evening's meal is to begin an expert discussion on the tastes afforded by these spoons.

The Menu

In order to bring the research and the spoons into the world of culinary experience, we formed a relationship with Quilon, a Michelin-stared Indian restaurant. After a number of discussions and taste testing sessions, the following menu has been constructed to provide an array of flavours for you to try using the spoons.

On Arrival
Popadums with coconut and tomato chutney
BEER: Ceilidh Lager (Williams Bros, Alloa, Scotland 4.7% ABV)

Course 1
Lotus stem chop with mango sauce and grilled scallops
BEER: 312 Urban Wheat Ale (Chicago 4.4% ABV)

Course 2
Peppered shrimps (served hot and cold) with batter fried shrimps cooked in fiery masala
BEER: Innis and Gunn (Scotland, 6.6% ABV)

Course 3
Mini vegetable dosa (thin rice and lentil pancake filled with tempered potatoes, served with sambhar) and coconut cream chicken (marinated chicken fillets with ground coconut, chilli and cumin, cooked over a griddle)
BEER: Brewsters Pale Ale (England, 5% ABV)

Course 4
Quilon salad (pink grapefruit, roasted beetroots, patty pan, mixed salad leaves with goji berry and honey dressing)
Baked black cod (subtly spiced chunks of baked cod)
BEER: Pietra (Corsica, 6% ABV)

Course 5
Kerala chicken roast (chicken morsels cooked with onion, tomato, black pepper and herbs)
Cauliflower chilli (crispy fried cauliflower tossed with yogurt, green chilli and curry leaves)
BEER: Duvel (Belgium, 8.5% ABV)

Course 6
Lamb biryani (combination of basmati cooked with traditional malabar spice in a sealed pot, served with pachadi and a lamb sauce) with coconut, asparagus and snow peas sauteed in mustard seeds, curry leaves, green chillies and grated coconut
BEER: Chalky's Bark (Sharp's, Cornwall 4.5% ABV)

Course 7
Mango sorbet with cold pressed honey ice cream
BEER: Liefmans Fruit (Belgium, 4.2% ABV)

Your Notes _

(Please feel free to use this page to make notes on the taste of the spoons and the experience of eating with them.)

What Next

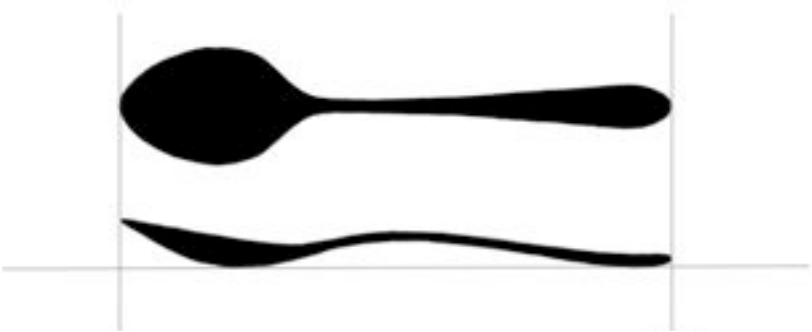
As one might expect, making the spoons, conducting the research and introducing the spoons to various experts and food stuffs has thrown up many more questions and avenues for further investigation. It is our hope that we will continue this project in the following ways.

Materials:
There are clearly more materials for whose tastes can be investigated. For example, many woods, plastics and papers are used to create disposable cutlery and tableware. A better understanding of the taste of these materials and the effect they have on food eaten from them could enable the manufacturing of better disposable cutlery, tableware or packaging that could enhance specific aspects of the food.

Foods:
More work can be done in pinpointing the specific effects of different pH levels in foods on the cutlery from which the food is consumed, since pH is known to affect the galvanic potential of metals. We would also like to work more directly with chefs to bring our findings and designed objects into restaurants.

Texture:
We have recently conducted a series of experiments into the affect of surface temperature on the perception of materials and have two research papers being considered for publication that examine the effects of temperature and texture when encountered by the hand and the mouth. It should be possible to introduce this work to the design of spoons, forks or cups in order to produce a range of surface finishes that affect, in an understandable and controlled manner, the experience of eating.

Form:
A desired outcome of the project is the creation of an entirely bespoke set of spoons, and possibly forks, that use science to produce the ideal object for eating specific foods. Imagine a set of spoons with one designated as ‘ideal’ for dairy, another for stirring tea or coffee, a third for sweet foods, a fourth for spices etc.



The Taste Team

Core Team:
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Food and Drink:
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The Institute of Making

The Institute of Making is a multidisciplinary research club for those interested in the made world: from makers of molecules to makers of buildings, synthetic skin to spacecraft, soup to cloths, furniture to cities. Our mission is to provide all makers with a creative home in which to innovate, contemplate and understand all aspects of materials and promote, inspire and celebrate their relationship to making.

At the heart of the Institute of Making are the Materials Library and the MakeSpace. The Materials Library is a repository of some of the most extraordinary materials on earth, gathered together not only for scientific interest, but also for their ability to fire the imagination and advance conceptualisation. The MakeSpace is the workshop of the Institute of Making, offering a broad range of tools and machinery to boil, bake, turn, mill, mend, spin, print, cut, cast, drill, sand, scrape and make.

The Materials Library and MakeSpace sit side by side in their custom built home at University College London, enabling users to experience at first hand the relationships between materials and tools that constitute multifaceted processes of making.

Acknowledgments and Contact

We are grateful to the Leverhulme Trust who funded this work.

For more information on the taste of materials and spoons projects, collaborations and future work, please contact Zoe Laughlin via email: zoe@instituteofmaking.org.uk

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