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## Introduction

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### 1. Challenges of conservation of contemporary food-based art

In 2000, the Municipal Museum of Contemporary Art (S.M.A.K.) organized the major exhibition *Over the Edges* in Ghent. That year, I was a student in the postgraduate program *Conservation of Contemporary Art* and I assisted the Belgian artist Jan Fabre and the Kosovar Albanian artist Sisley Xhafa (based in New York) with the installation of their food-based artworks. This exhibition displayed more than 50 temporary site-specific projects, throughout the city of Ghent. The artworks were created as experimental and experiential processes. Artists interacted with the context of their artworks and, some of them adapted their installations during the course of the exhibition (Hoet 2000).



Fig. 1 Jan Fabre: *Untitled*, 2000, *Over The Edges*, Ghent.

Jan Fabre, who covered the pillars of the Aula Academica neoclassical building from the Ghent University with slices of dry cured ham, had to adapt his installation *Untitled* (2000) (Figure 1). Each piece of ham was stapled onto a polystyrene undercoat and each pillar was then shrink-wrapped in cellophane. In this case, the adaptation of the installation was determined by the perishable nature of the food materials, as the slices of ham were rotting under the plastic sheeting.

The artist, Jan Fabre forced passers-by to reflect and engage with social and political issues, by 'skinning the legs of the house of reason'. The façade of this university building, inspired by the architecture of ancient temples, consists of a huge colonnade, a triangular pediment and, a stately stairway in black marble. By covering the building with dry cured ham, Fabre made the pillars resemble to marble. From the beginning of its creation process, the work provoked a lot of protest by the audience, especially because of the food wasting (Marijnissen 2002). After two days,



Fig. 2 Jan Fabre: manifestation in front of the artwork, *Untitled*, 2000, *Over The Edges*, Ghent. personal translation of the slogans: 'Meat industry = animal suffering', 'Ethiopia = famine... a crazy man is wasting fresh meat', 'With this money the homeless can be helped', 'Is this art? Over my dead body!'.

the curators decided to complete the installation during the night, because angered animal rights groups were constantly interrupting the staff during their working practice. At the opening of the exhibition, some people manifested in front of the work (Figure 2). Certain groups of people became increasingly aggressive and finally private security guards had to be hired to protect the work 24/7.

Like many of Fabre's works, this installation was about transformation, a common theme in the artist's oeuvre, e.g. his insect installations, in which he uses the metamorphoses of the materials as subject of investigations (website Jan Fabre). According to Jan Fabre, the rotting process and the accompanying smell of the ham were supposed to make the decay of the installation tactile during the exposition (Hoet 2000, Gilman 2006). After 2 months, the health department of the city decided to remove the piece because of mould development and rancid odour, even though the exposition lasted for 3 months. Instead, the food installation was exchanged by a big picture of the artwork, which was shown until the end of the exhibition.

In another food-based installation, *Pleasure our flower* (Figure 3) by Sisley Xhafa, which was also shown during *Over The Edges*, the waiting room of the Ghent police station was transformed into a comfortable hotel lobby. Xhafa decorated the room with Biedermeier chairs and Persian carpets. People could drink whisky, champagne and red wine and eat all kinds of fresh fruit, while reading a book or listening to *Vivaldi*. In this case, the adaptation of the



Fig. 3 Sisley Xhafa: *Pleasure our flower*, 2000, *Over The Edges*, Ghent.

installation was determined by the consumption and, by the perishable nature of the food materials. The artist stipulated that the fruits needed to be fresh and, that they had to be replaced in case of spoilage. As the fresh food and drinks in this installation had to be consumed, museum staff had to replenish the fruits when they were not at the disposal of the public anymore.

Xhafa often questions prejudices and racial stereotypes in his installations by using provocative strategies. In *Pleasure our flower*, he brought up the theme immigration, referring to his own history as an immigrant towards Western Europe. Xhafa wanted to underline the contrast between the cosy atmosphere he created in the waiting room and, the coolness of the police officers executing their job (Personal Communication with the artist, March 2000).

This installation needed specific care during the course of the show in order to correspond to the artist's wishes. For the artist it was really necessary that the fresh fruits and drinks were at the disposal of the audience. Although the installation was continually supervised by police officers, the bottles of alcohol were stolen after a few days. The curators of the S.M.A.K. decided then to fix the new bottles of alcohol on the cupboard.

As demonstrated in those two examples, food-based art extends, more than other artworks, the sensory perception by the direct confrontation with the fundamental human need for the intake of food (Fabre) and, by the association of the pleasure of eating and drinking (Xhafa). In both cases, the museum professionals had to deal with reactions by the audience. Those works needed an active engagement in their care: hiring security guards in the case by Fabre and fixing the bottles in Xhafa's case.

Furthermore, the conceptual nature of those installations and the perishable nature of food caused specific problems for conservators. To determine the appearance and functioning of those installations, it was important to gain insight into the artist's intention and into the degradation processes of the food. Both artworks were designed to stimulate some type of action: degradation and consumption of the food. According to Fabre, the transformation of the dry cured ham by degradation was necessary. According to Xhafa, the replenishment of the fruits was necessary to function.

Especially in Jan Fabre's work *Untitled* the dematerialization of this installation was self-evident once the exposition was finished. But, would the installation have survived the exhibition if the ham slices were treated against degradation? Which kind of treatments would be possible, in order to respect the artist's intention concerning the visualization of decay processes? Could a decision for treatment be justified in this case? Which stakeholders steer those kinds of conservation decisions? All those questions highlight a part of the main issues of the conservation of food-based artworks. Conservation of such installations implicates the preservation of the materials used, but also respecting the artist's intention.

The food-based installations by Fabre and Xhafa demonstrated the need for short-time preservation care for food-based artworks. Because of the ephemeral and perishable nature of these artworks, conservators were forced to think about short-time preservation management. As one can imagine, specific conservation attention is also needed for artworks with a more permanent character and, long-term preservation management has to be developed.

## 2. Research context and method

### 2.1. Definitions and terminology

The terms preservation, conservation and restoration appear frequently in the issues discussed in this PhD research. Those common-language expressions do not always allow for the required level of precision, although, some conventions were established (See for instance the *American Institute for Conservation (AIC)* definitions of conservation terminology 1996 (website AIC), conservation terminology (Munoz Vinas 2005), ICOM-CC Code of ethics 2008 (website ICOM-CC), definitions of damage (Ashley Smith 2011)). The confusion is related to translations that are often imprecise. Some authors and organizations use different expressions as synonyms of 'conservation' in the broad sense, such as 'preservation' or even 'restoration', which causes confusion. As in any reflection upon conservation, the clear and consistent use of terms is a must. Therefore, it is required for this study to explain some of the terms employed by the conservation profession.

The terms 'preservation', 'conservation' and 'restoration' in this research were used as discussed by Salvador Munoz Vinas in his book *Contemporary*

*Theory of Conservation* (2005). Although, when authors have been quoted, the definitions mentioned here were not always valid, as the quoted texts were maintained as originally written by their authors.

Munoz Vinas (2005) explains what these terms exactly mean in the common usage by the conservation profession.

The term *conservation* is used to refer only to conservation in the broad sense: conservation as the sum of the activities included in the narrow sense (see preservation) plus restoration and other possibly related activities. The term *preservation* is used to conservation in the narrow sense, which means conservation as opposed to 'restoration', referring to the 'keep' activity. The term *restoration* is used by Munoz Vinas as described by McGilvray (1988): *there are three alternatives in dealing with an existing historic resource: we can 'keep' it, we can 'change' it or we can 'destroy' it.*

Munoz Vinas (2005) divided preservation into: informational preservation, direct preservation and environmental preservation. According to him, informational preservation refers towards the activity in which some features of the object are recorded or reproduced. Informational preservation does not actually preserve the object and involves all kind of documentation of the artwork, such as photos, videos, manuals, etc. Direct preservation changes the object by an action limited in time (e.g. applying protective coatings). Environmental preservation changes the environment of the object by an action not limited in time (e.g. temperature stabilization).

As in this study, preservation methods from the food industry were addressed, it is required to explain the terminology frequently used in this area in relation to Munoz Vinas classification (Figure 4). In the field of the food industry, the term *preservation* covers the process of treating food, to stop or, greatly slow down, spoilage (loss of quality, edibility or nutritive value), caused or accelerated by microorganisms, enzymatic and chemical processes occurring in food. Food preservation usually involves: preventing the growth of bacteria, fungi and other microorganisms as well as, retarding the oxidation of fats. Oxidation processes can cause rancidity or discolouration that can occur during food preparation (e.g. the enzymatic browning reaction when apples are cut) (Devlieghere et al. 2011). Different preservation techniques were studied, in order to prolong the shelf life and to increase the microbial safety of food products. In the food industry, physical and chemical preservation techniques are used. In

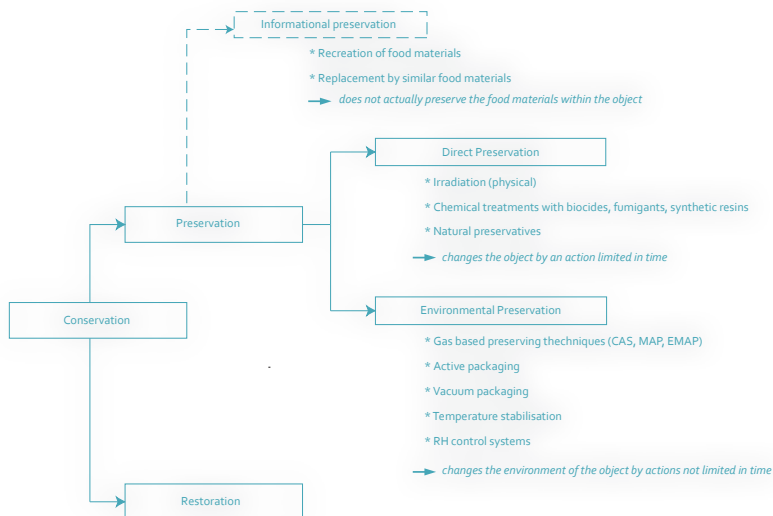


Fig. 4 Classification of activities with the conservation of food-based art (adaptation of Munoz Vinas classification)

this study, informational preservation refers to food production methods for which knowledge of food science is necessary, when food materials are reproduced. The physical preservation technique irradiation, described in this research, can be categorized under direct preservation. Environmental art preservation is based on preventive or inhibitive preservation methods that can be physical and/or chemical methods. The physical food preservation techniques, such as different methods to control the environment (e.g. relative humidity (RH) control system, temperature stabilization), can be categorized under environmental preservation. Also, the chemical preservation techniques (e.g. using a protective case in which an anoxic free environment is created, the use of an oxygen-free chamber) can be categorized under Munoz Vinas environmental preservation.

## 2.2. Research context and case studies

Because of the constantly growing number of food-based artworks, conservators worldwide underlined the need for research in this area. Different conservators brought up their struggling with artworks made by food materials, especially for works intending to perform decay. Consequently, a lot of the problems of conservation of food-based art

were addressed during international conferences and during several discussions on websites and internet-platforms, focusing on the conservation of contemporary art.

The conservation of contemporary food-based artworks is a challenge, as the significance of these ephemeral works is very much dependent on whether and how their existence is physically and conceptually continued. As a result, it is not surprising that currently there are no general conservation strategies for ephemeral art with food. Conservators should not only consider the conceptual dimension of the artwork and the presentational requirements but, also consider the techniques the artist used to produce the work, the nature of the food materials and, in particular, their susceptibility to degradation. Those works inevitably alter in appearance and, therefore, they require intervention to enable their display.

Following the movement towards an ethnographic approach in studying conservation of contemporary art, a qualitative approach and 'participant observation' research method was used. Research in the conservation of contemporary art moved towards ethnographic approach to analyze artworks. This methodology is used within the conservation field in the form of community consultations. The central aim of ethnography is to provide insights into people's views and actions, through the collection of detailed observations and interviews. Furthermore, with this method it is possible to map decision-making processes in conservation, which give insight into the reason of the application of certain preservation treatments (See Pinxten 2006, Wharton 2008 & Hummelen et al. 2008). During this research, a lot of information on conservation practices and decisions were obtained via informal interviews and conversations with museum professionals, scientists, artists and others involved in the conservation and presentation of contemporary art. Also, established networks, such as INCCA (website INCCA) and ICOM-CC (website ICOM-CC), where information on the conservation of modern and contemporary is shared, were consulted. By conducting research into museum practices, it was possible to have an immediate experience of the context for conservation of the studied artworks. The real challenges for the conservation of food-based works became clear during participation in the daily conservation practices in Belgian museums such as the S.M.A.K. in Ghent, the Museum of Contemporary Art In Antwerp (M UHKA) and the Museum of Industrial Archaeology and Textile (MIAT) in Ghent and the participation in the building up of major expositions (such as *Over The Edges*). Especially interesting for this research was experiencing the problems of short-time

preservation and the problems of long-term preservation for some of the perishable food-based artworks.

In order to study short-term preservation management, two food-based artworks by Belgian artists were selected: *Untitled* (1981) by René Heyvaert and *Autoportrait* (2005) by Wim Delvoye. *Untitled*, consisting of bread-rolls, by Heyvaert belongs to the M HKA collection and is remade each time it has to be exhibited. In 2009, during the exhibition *A story of the image* in Singapore, museum professionals experienced food deterioration and pest. Therefore, they protected the work during all following exhibitions by presenting it in a plexiglass showcase. In order to optimize preservation during display, the knowledge of food preservation science was introduced and evaluated. Furthermore, the contribution of food preservation knowledge during display was investigated when the work *Autoportrait* (*Chantal, Catherine, Smoking Girl and Smoking Boy*), consisting of embroidered ham slices, by Wim Delvoye was exhibited in 2005 during the exhibition, *MéTissages Art and Textile Biennale* in the Museum of Industrial Archaeology and Textile (MIAT) in Ghent. Due to the perishable nature of this food-based artwork, short-term exposition was problematic. By introducing a frequently applied food preservation method from the food industry, Modified Atmosphere Packaging (MAP), the work survived the exhibition period.

In order to study long-term preservation management, several cases from the S.M.A.K. collection were selected. S.M.A.K. constantly pursues a dynamic interaction between their permanent collection and temporary exhibitions. The museum collected a whole range of works by Joseph Beuys, including a lot of works with food products such as *Butter and Beeswax (basic material, 4bis)* (1975-1986) and *Wirtschaftswerte* (1980). Both artworks were selected for this research. From a historical point of view, Beuys is seen as one of the most important and most influential artists from his generation and he exemplifies one of the leading artists using food materials. For Beuys, specific food materials, such as chocolate, sausage, gelatin, margarine, and butter have to perform decay. In order to respect the artist's intention, his artworks require specific preservation care for which the importance of food science knowledge was demonstrated, during experimental laboratory research and, during research into museum practice. In both cases, the application of the food preservation technique MAP was evaluated: for *Butter and Beeswax* during an experimental laboratory research and for *Wirtschaftswerte* after the application by the museum during storage.



Other perishable food-based artworks, belonging to the S.M.A.K. collection, in which decay processes had to be maintained, were further investigated. The food-based artwork *Eggs* (1997), by the Belgian artist Peter De Cupere, containing raw eggs and baked chicken skin, was also selected for experimental laboratory research, in order to analyze the combination of two different food preservation techniques: Modified Atmosphere Packaging (MAP) and irradiation. The food-based installation *Piece in Ghent (P.I.G.)* (1994), containing French fries, by Jason Rhoades, a work managed by S.M.A.K., was also examined. Concerning the French fries, different conservation approaches were considered, based on the interpretation of the artist's quotes and instructions. The role of food science was evaluated for two possible conservation approaches, reproduction of new French fries and, preservation of the original French fries.

Furthermore, *Strange Fruit (for David)* (1992) by Zoe Leonard, consisting of fruit peels she sewed together with wires and threads, was selected for the experimental laboratory research in order to evaluate the application of MAP. Also, in this case, it was the artist intention to let the work perish. As this perishable work was acquired by the Philadelphia Museum of Art in 1998, museum professionals were in search for a solution, in order to improve its preservation during storage.

In all those cases, the context for conservation was determined by analyzing the production method of the artwork, the artist intention and the degradation processes of the food materials.

### 3. Objectives

The main objective of this research was to analyze the role of food preservation and food science knowledge, in the context of conservation of contemporary food-based art. Taking into account the ephemeral nature of food-based artworks and, the conceptual meaning of those contemporary artworks, there was the question of where the endpoint lies of such 'living works'. The answer to this question seemed complex, as in the context of conservation of contemporary art *change* comes in all forms and in different degrees. For instance, for contemporary food-based artworks the decay processes of the food materials are often intrinsic to the meaning of the work. Because of the perishable nature of the food, those food materials need sometimes to be reproduced. In both cases (preservation and reproduction), food preservation methods

applied in the food industry and knowledge on food science could offer a suitable approach for art conservators.

In order to comprehend the context for conservation, it was recommended to analyze how museums dealt with such changing artworks in their daily working practices. Which were the criteria to decide what could change and what not? The development of new strategies for the conservation of contemporary art by the art conservation profession provided a clearer view, in order to define the museum practices in which *change* was considered. In those practices, the focus tended more on the conceptual dimension and presentational requirements of the work, in which the original intention of the artwork was kept. Conservators today emphasize the necessity of preserving the integrity of the artwork respecting the artist's intention, which is not always to stop the deterioration of the food materials or preserving the 'original' materials. Therefore, it was crucial to determine the context for conservation by analyzing the significance of food in art in the 20th century. Why did artists use those specific materials and how did they use them to shape different kinds of artworks?

Also, because of the perishable nature of food materials, it was important to have insight into their deterioration processes. In the effort to preserve ephemeral artworks and in order to comprehend the causes of decay, museum professionals utilize the tools of science. Scientific research gives conservators a clear view on the behaviour of the materials and it helps to assess the artwork's condition. Conservators and scientists cooperate in order to design, evaluate and apply preservation treatments that can provide long-term preservation for artworks. Therefore, knowledge about the behaviour of food, and in particular about their preservation in the food industry had to be gathered.

Experimental laboratory research made it possible to understand some food degradation mechanisms in three food-based artworks and, to evaluate some possibilities and limitations of the application of food preservation techniques on artworks. This research was predominantly technical in nature, as it focused on identifying and monitoring the degradation mechanisms of the food-based works.

Furthermore, the focus in this study was on the development of conservation approaches which could prevent perishable food-based artworks to disappear, by slowing down the deterioration of the food materials or, by reproducing the food materials, in such a way that

their preservation is maximized. The ultimate objective of this PhD research was to evaluate the role of food preservation and production science into the conservation of contemporary food-based artworks, with a primary emphasis on applicability and sustainability in a museum context. By introducing the knowledge of food science, the deterioration mechanisms of food in art became clear and compatible treatment options were given. The museum practices, the problems and potential solutions, for presenting and conserving two food-based artworks, was discussed. The application of food preservation techniques during storage and during display was also evaluated for two artworks. The cooperation with museum professionals was required, in order to evaluate the implementation of food preservation and production techniques.

#### 4. Outline of the PhD research (Figure 5)

##### 4.1. PART 1: Creating context for conservation and the significance of food-based art in the 20th century

The first part of the research was dedicated to contemporary art conservation in general and the significance of food materials in the 20th century art. The first chapter gave a brief overview of the conservation practices for modern and contemporary art, based on general conservation literature. Since the 1990s, issues pertaining to the conservation of modern and contemporary art played a major role in the international debate. In this debate, conservation issues concerning food-based art were highlighted, with a special focus on methods and techniques of documentation and, with the focus on studies of new art materials and new media. One of the main questions in this debate was 'whether there should be specific theoretical and ethical guidelines for the conservation of contemporary art'. The fact that this contemporary art is more concept-based than classical art and, the fact that the 'living' artist can be involved in the decisions of conservation, challenged the conservation profession. Therefore, this first chapter was based on literature in which the evolution of established traditional conservation theories and principles towards the present-day theoretical principles were considered. Herein, special attention was given towards the role of science, to new approaches in contemporary conservation and, on how this changed the role of the conservator since the 1990s.

In the second chapter, an overview of food-based art was given from the first artists who used food as art materials. It was explained how those artists produced their works and with which intent they designed their works. Special attention was given towards the significance of food-based art and functionality. Since the 1960s, artworks that had to perform some action became very popular. Those artists explored the possibilities of this approach in a number of ways by, for instance, requesting to interact with their work or, by producing art with organic materials destined to deteriorate. More and more, food materials became used in this kind of intangible and performative art. A thorough historical account went beyond the aim of this research, but the intent was to provide the reader with some historical context. Highlighting some developments in the use of food materials and, analyzing why artists started to use those materials are necessary to comprehend the conservation challenges of those artworks. Moving from art outside the museum towards artworks in the centre of the museum activities, this second chapter, briefly reviewed some major eat art exhibitions and paid attention towards the introduction of food-based art into museum collections. Once food-based art was purchased and entered the domain of a museum collection, the conservation problems became clear. Furthermore, different more recent retrospective exhibitions with food-based art were mentioned in this chapter, as even during display, conservation issues appeared. Hence, the need for an in-depth research on this issue came along.

The third chapter focused on the specific issues of conservation of food-based art. Firstly, some exhibitions, in which conservation issues became the subject of investigation during display, were mentioned. Secondly, an overview of the conservation research and current practices on food-based art was given, in order to capture the hiatus. Furthermore, it was explained why categorizing such contemporary artworks is plainly impossible. Although artists use one kind of organic food material, the techniques they use, the meaning they give towards the food materials etc., are very different. Also, the importance of documenting this organic perishable art was underlined. Committed to prolong the physical life of artworks in the face of inevitable change, conservators were, and are, vexed by art that questions notions of permanence, which became clear throughout this chapter. By using the terms 'intangibility' and 'performativity', introduced by Munoz Vinas (2010), the complexity of food-based art became clear and, the conservation issues were captured. Those two terms helped to understand the difficult theoretical challenges of food-based art.

#### 4.2. PART 2 : Preservation of food-based art and food preservation techniques: Degradation processes and potential solutions

The second part of this PhD research focused on food preservation science and was subdivided into two chapters. By offering insight in food preservation science, this part of the study contributed to the problem of presentation and conservation of those perishable artworks. The 4th chapter briefly explained the degradation processes of food materials and their intrinsic and extrinsic parameters. This chapter helped to have a clear view on many issues surrounding the behaviour of the food materials, which furthermore helped to assess the condition of food materials in artworks. Also, special attention was given towards the differences of the parameters of food materials in comparison with other art materials.

The goal of the 5th chapter was to give conservators insight into the implementation possibilities and limitations of food preservation techniques. In the field of food science, a lot of research focused on preservation technologies, such as new packaging systems. Chapter 5 intended to give the reader information on packaging techniques that could be implemented in a museum environment, in order to protect food-based artworks from microorganisms spoiling it.

#### 4.3. PART 3: Art & Food: translation to conservation practice

The third part of this study focused on case-based research, which was mainly practice oriented and, which was subdivided into two chapters. Chapter 6 evaluated the results of an experimental laboratory research (Gilman 2001), performed in cooperation with the Museum of Contemporary Art in Ghent (S.M.A.K.) and the Laboratory of Food Microbiology and Food Preservation at the Ghent University (UGent). In this research, preservation possibilities for three food-based artworks were examined: *Butter and Beeswax* containing packs of butter, by Joseph Beuys and *Eggs*, containing raw eggs covered with baked chicken skin, by Peter De Cupere (both belonging to the collection of S.M.A.K. in Ghent) and *Strange Fruit (for David)*, containing different kinds of fruit peels (belonging to the Philadelphia Museum of Art). The goal was to explore the application of Modified Atmosphere Packaging (MAP) and irradiation for the preservation of those food-based artworks. Both techniques are used in the food industry for the preservation of food products present in the food chain. Dummies of the artworks were made and subjected

to accelerated ageing. From the results obtained, guidelines to preserve those works were proposed.

In chapter 7 the research focused on food-based cases in their museum environment. The problems and potential solutions for the presentation and conservation of two food-based artworks were investigated on a purely theoretical basis: *Untitled* (1982, M HKA), containing bread rolls, by René Heyvaert and *Piece in Ghent* (1994, S.M.A.K.), containing French fries, by Jason Rhoades. The role of food preservation and food science in the preservation of the food in these artworks was discussed against the potential of a reproduction of the food.

Furthermore, the application of food preservation techniques in a museum environment was evaluated through two food-based cases, for which conservators and curators searched for an adequate preservation solution: *Wirtschaftswerte* (1980), containing several food products, by Joseph Beuys and *Autoportrait (Chantal, Catherine, Smoking Girl and Smoking Boy)* (2005), consisting of embroidered ham slices, by Wim Delvoye. The conservation issues and museum practices were evaluated and, propositions for preservation during storage and during display were made. After the application of food preservation techniques by museum professionals, propositions for improvement of the preservation were made.

#### 4.4. PART 4: General discussion and conclusion: The role of science in the conservation and presentation of contemporary food-based art

The last part reviewed the study of preservation possibilities for the different cases, which were studied in depth during this research. Expectations of how long conservators could prolong the 'life' of the particular cases under normal museum conditions, using the different food preservation techniques, were made. Next to some conclusions that could be made for each of the studied food-based artworks, more general preservation guidelines to preserve food-based art were given. The different food preservation methods and their implication, when applied during storage and display of food-based art, were evaluated. Furthermore, the distinction between the display and storage whether or not preserved with food science-based techniques was made. The advantages and disadvantages of each of the studied food preservation techniques were listed, so that art conservators have a range of approaches and treatments to preserve perishable food-based art.

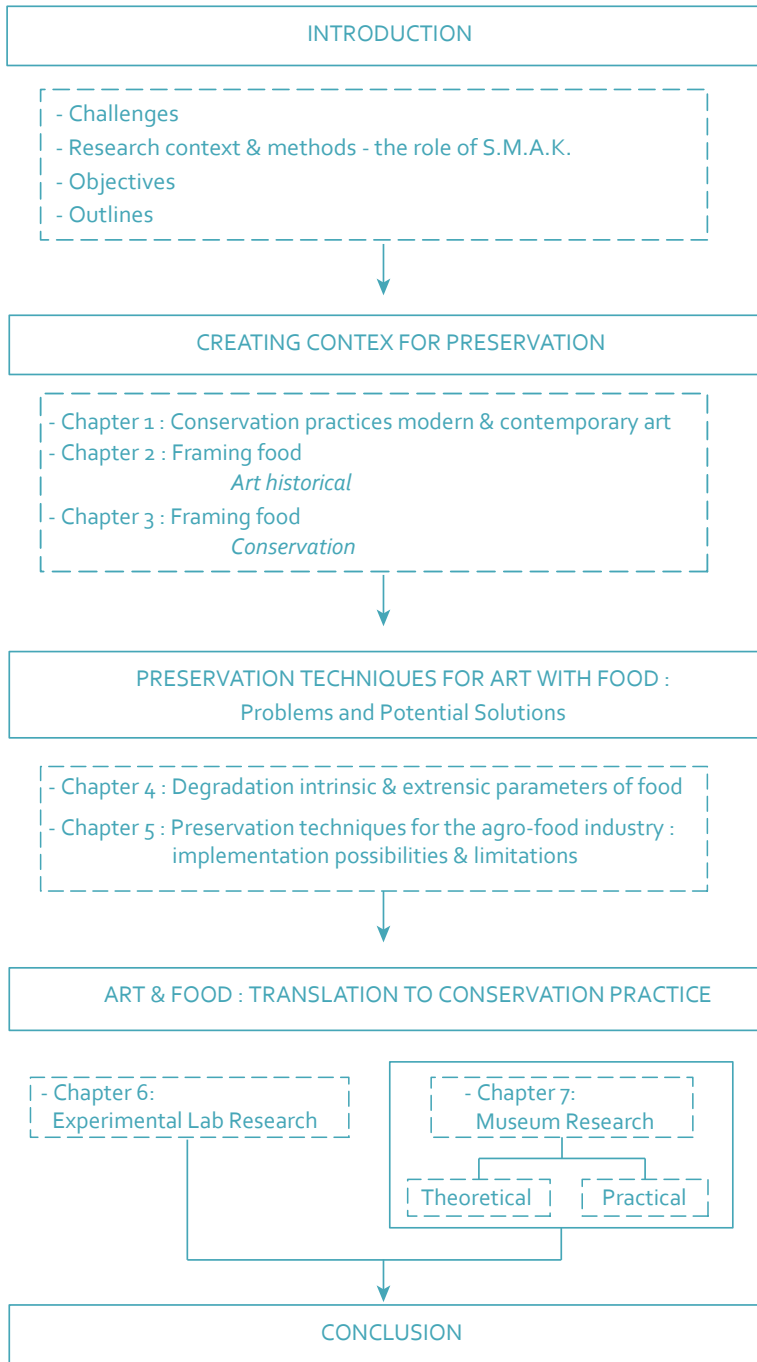


Fig. 5 Outline of the PhD research: The role of science in contemporary art conservation. A study into the conservation and presentation of food-based art.





# PART I: CREATING CONTEXT FOR CONSERVATION AND THE SIGNIFICANCE OF FOOD-BASED ART IN THE 20TH CENTURY

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## Chapter 1. Conservation practices for modern and contemporary art

### 1.1. The role of science: traditional conservation versus contemporary art conservation

The role of science in the conservation of artworks was always of importance. The conservation profession agrees that the conservator's role in preserving a physical object is clear, but the conservator's role in the interpretation of the artwork is not so obvious. Yet interpretation is unavoidably embedded in every conservation treatment. Several authors (Keene 1996, Marijnissen 1996, Brandi 1996, Appelbaum 2007, Munoz Vinas 2005) brought up the difficult relationship between conservation, physical sciences and social sciences. According to them each object and its context should be evaluated individually and each conservation decision involves value judgements. The urge to include non-material information along with material data was underlined by those authors. Conservators should also inquire about the values of the art objects for any other stakeholder. Therefore the reconstruction of the full history of the object that includes historical, cultural and ethical issues, leads to the choice of the ideal state. The conservation methodology includes: characterizing the art object, reconstructing its history, determining its ideal state, establishing the goal of treatment, choosing the treatment methods and materials, collecting treatment documentation and carry out the treatment (Appelbaum 2007). Although the field of art conservation places conservation within the context of social sciences, the most common conservation approach felt in the domain of physical science. This is most probably due to the fact that conservation training was more focussing on material-based aspects of artworks instead of the most vexing ethical dilemmas that conservators have to face (Appelbaum 2007). As there are no clear guidelines that define the boundaries between a proper and improper conservation treatment, conservators were blurred. Traditionally they tend to rely on material-based information to conserve artworks.

The field of conservation relied on the authority that an artwork's meaning lie in its physical nature. Many of the ideas set out in conservation practice can be traced back to notions developed in the so-called traditional conservation theory in which the conservation strategy was based on 'freezing' material objects (Villers 2004, Munoz Vinas 2005). In the 'freeze frame paradigm' the predominant idea is that artworks have an ideal single state that coincides with the supposed original state. In traditional conservation the notion rules that artworks have a 'true nature' that can be identified and preserved as close as possible to their historic and authentic state or can be restored to this state by means of intervention (Villers 2004, Munoz Vinas 2005, Hummelen et al. 2008). According to the *Guidance for Conservation Practice* (United Kingdom Institute of Conservation, London UKIC 1983) *this 'true nature' comprises, evidence of its origins, its original construction and the materials of which it is composed and information about the technology used in its manufacture.*

Traditional art conservation focused on preserving the physical object with the help of scientific and art technological research (Coremans 1996, Torraca 1996, Urbani 1996, France-Lanord 1996). Scientific research focuses on studying the deterioration mechanisms of objects of art and designing conservation treatments that can provide long-term preservation and stability to artworks. As alterations are a consequence of practically irreversible processes of destruction traditional conservation treatments focused on slowing down processes of destruction and thus ensuring the survival of artworks. Art technical research focuses on the composition and on the technologies used to create artworks. In addition archaeometry is used to support this art technological research, including the dating and analysis of materials, the authentication of artworks and the identification of artworks.

When it comes to define contemporary art the 'freezing' of material objects poses problems, as a lot of the contemporary artworks cannot be preserved in a supposedly authentic state (Villers 2004, Munoz Vinas 2005, Hummelen et al. 2008). In modern and contemporary art the practical and interpretative problems that arise in relation to durability and ephemerality were exacerbated by an art-historical methodology that tended to privilege theoretical interpretation over concrete object study. The descriptive knowledge that defined and contextualized the objects left the field of art history and was situated instead within the domain of art conservation (Learner 2008). The conservation profession accepted the interpretative role in the context of old master artworks but blanches at the prospect of making essentially similar decisions about

“acceptable” deterioration in contemporary art (Albano 1996). Since the 1960s the idea that an artwork is an autonomous, unchanging object has been challenged by art forms such as conceptual art, happenings, performances, installations and new media art. Artworks made of new, more fragile and less sustainable materials, site-specific installations, performances and artworks involving obsolete technologies imply that these artworks might be changeable in their nature (Hummelen et al. 2008). The problem with this changeable nature of contemporary art was that conservators understood it in reference to the supposed original physical state. But the meaning of changeable art lies not always in its pure physical nature. Furthermore because change is irreversible it was often defined as damage or loss (Laurenson 2006).

With contemporary works there is thus a blur when it comes to questions of meaning and material. The content of contemporary artworks such as ephemeral art, site-specific and time-based media, that have to be performed, degrade or replaced, are not so easy to pin down and transpose. Curators and conservators dealt with the fundamental issues of practical decision-making in conservation and presentation of such artworks. Ephemeral art challenged not only the well-known codes and ethics of conservation, but questioned the definition of the artwork itself. As traditional conservation guidelines focused too much on the preservation of a fixed object they had to be redefined in the context of contemporary art (Munoz Vinas 2005, Wharton et al. 1995, Hummelen et al. 2008).

Museum professionals started to question the supposed neutrality as institutional context, through the conservation and presentation problems from the experimental genres. They searched for alternatives for the conservation of physical objects to represent those artworks, which became more and more influential, in their collections. While traditional methods mainly focused on the problems of physical and chemical changes, new strategies for contemporary art conservation try to deal with artworks for which ‘change’ is intended from the beginning of the work’s conception (Lippard 1973, Buskirk 2003, Munoz Vinas 2005, Laurenson 2005 and 2006). Because this contemporary art mostly involved ‘living artists’, they started to cooperate with the artists themselves in order to define this art and in order to decipher what exactly to conserve. Representing a lot of contemporary works cannot always mean finding out how to replicate the exact nature of the original object (Wharton & Molotoch 2009). Sometimes the use of perishable materials by conceptual-minded artists forced conservators to make decisions about

the continuity of the artwork on a more conceptual level. Complex issues are presented by contemporary artworks, where much of the meaning lies in the functionality (Munoz Vinas 2005, Wharton et al. 1995). If for instance degradation of the material is the main feature of the artwork, preservation means that the work is not allowed to function and the intent of the work has been lost. On the contrary, if the perishable materials are allowed to degrade, the functionality of the artwork destroys it.

In order to cope with such functional issues conservators of contemporary art focussed more and more on the so-called immaterial or intangible aspects in their research towards the significance of artworks (Wharton et al. 1995, Laurenson 2006, Hummelen et al. 2008). Throughout the 20th century the materials used in contemporary art forms obviously are a major factor in the significance of the work of art. The question 'Whether and in what way the material contributes to the substantive meaning?' is of pivotal importance, since this question plays a key role in the interpretation of the work in relation to its preservation. The question about the significance of the material became part of the bigger question towards the significance of the artwork (Wagner et al. 2002, Buskirk 2003).

The importance of concept and material in many of contemporary artworks is one of the dilemmas that conflicts with the traditional based established ethics of conservation (Buskirk 2003). Especially the question concerning the preservation of perishable materials became really problematic. As scientific and art technological research, which were key in traditional conservation, were insufficient to cope with the conservation issues of perishable art, the research in conservation focussed more on the intangible aspects of this kind of art. Furthermore in order to decipher the intangible aspects, conservators focussed on defining the concept of 'change' in contemporary art. In the last 10 years conservators became more able to cope with 'changing' artworks and accepted aspects of deterioration as part of the meaning of certain artworks. Because of interdisciplinary discussions on changeable art during several international conferences, the attitude towards these contemporary works changed. Following conferences were important: *Modern Art who Cares* (1997, Amsterdam) (Hummelen and Sillé 1999); *The object in transition: a cross disciplinary conference on the preservation and study of modern and contemporary art* (2008, Los Angeles) (website [getty.edu](http://getty.edu)); annual summits *Documentation and conservation of media art heritage* (2005-2010, Canada) (website [DOCAM](http://DOCAM.org)); lectures, seminars and workshops during *Inside Installations* (2004-2007 Amsterdam, Madrid, Karlsruhe,

Maastricht, Ghent, London) (Scholte and Wharton 2011 & website Inside installations); Contemporary Art who cares (2010, Amsterdam) (website INCCA). A wide range of approaches, some object-based, some more conceptual and philosophical, demonstrated that the authentic meaning of changeable art often includes competing values. In many cases even though the meaning of the artwork lied in a process implying change, conservators searched for methods to stabilize perishable artworks in order to hold a physical object. Because conservation helps to preserve some particular meanings, it helps to treat material objects that convey those meanings (Munoz Vinas 2010).

## 1.2. Approaches and decisions in the conservation of contemporary art

### 1.2.1. Authentic meaning and artist intention

Museum professionals intervened in many ways to enable continued display of works that rapidly alter in appearance and require some level of intervention. As there was no codified method for conserving such works, conservators were left with countless works that diverged from their original form. The role of conservators in the biography of an artwork was continuously questioned and discussed in contemporary art conservation (Van de Vall et al. 2011). Questions arise about the definition of what exactly constitutes the original object, especially for works made of ephemeral and unstable materials. The meaning may not specifically be tied to one element or object.

The problem is that in a lot of the contemporary works the intangible functions surpass original material functions. The increasingly rapid obsolescence of the materials and media used in ephemeral artworks drove conservators to re-examine the factors that define this 'authenticity' and 'integrity' and recognized that ephemeral art is based on variability in which 'change' is thus inherent. Especially problematic are perishable artworks as the materials posses an 'inherent vice', which results in the demise or disappearance of the work (Wharton 2005). The deterioration in some of the food-based cases for instance is so catastrophic that it resulted in a complete loss of the material. Although degradation is in a lot of those works integrated in the conceptual framework, the artist as well as the museum do not intend a complete loss in most of the cases.

Frequently debated within the art profession is how one balances the intention of the artist with more conventional conservation values. The challenges posed by modern materials often led in the first place to conservation decisions based on more subjective inferences about the artist's intention, an interpretive concept that many art historians view with some scepticism (Learner 2008). The artist's intention has always been an important consideration in the conservation of artworks as conservators are interested in identifying the artist's intent because they are concerned about honouring symbolic meaning, embodied by the professional codes of ethics (See among others: Albano 1996, Richardson 1996, Van de Wetering 1996, Dijkstra 1996). Since these codes do not provide full guidance for navigating the difficult terrain of contemporary art with ephemeral materials or in which 'change' is incorporated, the artist's role in the decision making process is more important than ever. To take artists' intentions and fix them into a framework would not do justice to artworks that have such a dynamic character. The contemporary artist, as the creator of an artwork, often makes endless decisions regarding the concept, context, choice of materials and experimental technique for its realization.

In the 1990s, an artist's intention was viewed as only important in the creation of an artwork. Artists' intentions of traditional artworks were not always available, nor desirable as standards for assessing art (Wimsatt and Beardsley 1946). Intentionalists, who insisted that artists' intentions could be a useful resource in interpreting works of art, quickly challenged this anti-intentionalist argument. The debate on artist's intention was significant for conservators working with contemporary art, as it made conservators aware of the necessity of an interdisciplinary approach (Dijkstra 1996, Ungaro 1999, Hummelen & Scholte 2004, Wharton 2005, Villers 2004, Laurenson 2006, Van Saaze 2009 and discussion focusing on artist intention *Artist's voice: History's Claim* during the conference *Object in Transition* (Getty Conservation Institute 2008) (website [getty.edu](http://getty.edu)). Steven Dijkstra (1996) explained *the artist's intentions and the intentional fallacy in fine art conservation*. According to Dijkstra the challenge for conservators is to judge the importance and application of artist's intentions in each case. He underlined the importance of the interdisciplinary task of applying artists' intentions to conserve artworks. Clear language among the disciplines is necessary in order to describe how artist's individuality and the individuality of his work can be fulfilled and maintained in conjunction with three other factors: the historical context in which the artwork is documented and perceived, the traditions of connoisseurship that give it reference; and the physical and

temporal characteristics of the media employed (Dijkstra 1996). Each artwork needs thus an individual approach, since other norms and values count. The artwork is indeed partly shaped throughout the choices made by the museum and the conservator at certain moments in time. Next to the gaining of information from artists directly is the discourse of a framework in which those works are received and interpreted (Buskirk 2003). During artist's interviews the interviewer can determine their answers. Conservators could for instance ask questions the artist did not already think through and that could affect his or her intention from then (Hummelen 2010, Learner and Levin 2009, Scheidemann 2010).

One of the main problems noticed when communicating and working with contemporary artists is that the artist's intention is not invariable. According to Christian Scheidemann (2010), a private conservator who is often involved in collaborations between curators or conservators on demand of the artist, there is a difference between intention and realization in the creative process of the artist. Scheidemann is especially known for his skills in working with food materials and for his openness to the possibility that art can be made of anything (Mead 2009). This conservator collaborated, sometimes for years, with a lot of artists who use food materials (see for instance descriptions of conservation treatments on works by Gober and Leonard in following chapters). He discussed the new definition of the term 'original' intention in relation to contemporary ephemeral artworks. According to him the definition of the term 'original' is more a field of options as the artist moves in his 'creative act' from 'intention' to 'realization' through a chain of subjective reactions. He investigated the first stages of art making, from the 'creation' to the 'fabrication', until the work comes into the art world where it can be collected. One of his concerns in the whole biography of the work is when the work is completed, as this completion refers to the condition where conservators refer to as being the 'original'. Especially for works in which the materials are intended to degrade this 'original' condition is problematic (Scheidemann 2010).

More artists became aware of the problems created by the use of ephemeral media and became prepared to cooperate with the museum to help them find the tools and methods to preserve these kinds of immaterial, variable works. Artists even demanded a voice in determining how their works had to be displayed, interpreted and in a later stage conserved (see chapter 2). There are many examples where a conservator researched the artist in-depth or even worked with him or her first hand to conserve a piece. Questions such as *What might constitute the medium*

and *to what extent can it be connected to the specific materials* became more important in understanding the 'meaning' of contemporary artworks. Because the themes, the processes of creation and the use of different media are affected by the artist's identity, the importance of the artistic intention was underlined (Buskirk 2005, Pugliese et al. 2009, Stigter 2009, Van Saaze 2009, Huys 2011, Beerkens et al. 2012).

But not all artists were and are prepared to outline the conservation strategies for their works. Some artists never made clear statements on the meanings they attribute to the material. So, in some cases conservators can only make mere assumptions about the meaning of the materials. Furthermore, the statements of artists are subject to multiple interpretations. Finding out the artist's intention thus confronts us with some practical problems. Those works are indeed linked with the moment they were created by the artist, but it is essential that conservators understand the whole context of the artwork's biography (Van de Vall et al. 2011).

Because of artist's changing attitudes in the course of time, it is perhaps impossible to correctly grasp the 'original' intention. This is one of the reasons why the notions of 'authenticity' in contemporary art conservation needed to be redefined. Therefore it is according to Hummelen and Scholte (2004) important that the tacit element of contemporary artworks with an ephemeral and/or conceptual nature are thoroughly discussed, documented and preserved along with the physical works. Conservators are bound to respect the artist's attitude without prejudice and take flaws as a challenge rather than as a 'problem'. Collaboration between the artist and the conservator has been beneficial for both artist and conservator. It can help the artist to understand the physical properties and ageing behaviours of the materials used, and it helps in the context of this research to learn about the particular choice, significance and application of the food materials without neglecting the performative aspects included in food-based art.

### 1.2.2. The changing role of the conservator

By looking at the historical roots of conservation practice the predominance of science, in which the practices were insistently material and science based, allowed conservators to hide behind supposedly objective and impartial methodologies (Van Saaze 2009). There was an absence of open discussions, because conservation decisions and treatments were very much a one-man operation (Lowenthal 1985, Caple



2000, Villers 2004, Munoz Vinas 2005 & Albano 1996). Since the 1990s the problems related to the conservation of modern and contemporary art became the focus of many conferences and research-projects. In the early 1990s Dutch museums joined forces by funding the project *Conservation of Modern Art* in order to respond to a growing need for alternatives to the traditional scientific conservation approach. The aim of this project was to find a methodological approach to conservation that took the complexity of modern art into account. By an interdisciplinary debate between conservators, art historians, curators and other museum professionals, artworks that were problematic to conserve, were studied. From then on more national and international collaboration for the preservation of modern and contemporary art started and an inventory of international expertise was made. Expertise was exchanged and methods for conserving modern and contemporary art were investigated (Hummelen and Sillé 1999).

To offer insight and provide structure in the decisions, decision-making and documentation models for contemporary art conservation were developed. The model developed by the *Foundation for the Conservation of Modern Art in Amsterdam* (Figure 6) (website SBMK) for instance, follows the standard conservation methodology in its emphasis on documentation, material-condition research and identifying the meaning or the artists' intent. This decision-making model forces a discussion of two types of discrepancies: the first is whether there is a discrepancy between the current condition of an artwork and its intended meaning, the second lies in considering options for conservation. The possibilities for conservation are weighed in the light of the risks and consequences that an eventual treatment would entail for the meaning of the work. By structuring and analyzing decision processes, conservators reflect more on their decisions and ensure respect for both the tangible and intangible heritage of visual art. The decision-making model also emphasizes the role of the constructed meaning of the work in the choice of a conservation method (Hummelen 2005). The fact that this model considers the artist intent, that it documents the rationale in each decision (as change can shift over time), that the importance of collaborative working is underlined and that it respects the transparency of each decision, makes that this document is still an important directory today.

The role of conservators as documentalists became important. Conservators started the documentation and archiving of work processes and artistic practices as alternative for the conservation of physical objects (Hummelen 2005). The conservation profession developed different models and tools for documentation and guidelines for artist participation in conservation. The so-called 'conservation by documentation' and digital registration of the ephemeral elements are among the most innovative methods. Via the Internet sharing and distributing knowledge within the international conservation community the focus on collaborative research was facilitated. Researchers developed documentation models, guidelines for conservation, terminology tools and systems aiming to help conservators dealing with ephemeral artworks. Museum professionals, teachers and students of participating universities and research centres produced all these tools and resources (website DOCAM, VMN, Inside Installations and INCCA).

Furthermore the establishment of the *Modern Materials and Contemporary Art (MMCA)* working group by the International Council of Museums- Committee for Conservation (ICOM-CC) and the growing amount of members of this group demonstrates that the contemporary art conservation community worldwide is becoming more mature. The conservation profession in contemporary art has grown towards a well-integrated network of researchers. A high level of collaboration between several major institutions (such as Getty Conservation Institute, MoMA, the Tate Gallery among others) also contributed to the research in conservation of contemporary art. Lectures during the triennial meeting *Cultural Heritage / Cultural Identity: The Role of Conservation* in Lisbon (ICOM-CC, 2011) and the conference *Contemporary Art: who Cares? (CAWC)* (2010) focused on the development of strategies and methods to conserve variable media. During these meeting the emphasis on documentation processes was underlined and special focus was given to the role of scientific research in this documentation. Given the complexities faced by the profession on how to conserve ephemeral artworks, the conclusion of the conferences was to provide as much information as possible for the next generation and then to proceed in a manner that acknowledges and respects the unanswerable questions through diligent discussion and avid documentation. Different participants underlined the importance of working in an interdisciplinary manner and the involvement of the artist in this.

The conservation activity positioned itself more towards sites of discovery and laboratories in which interdisciplinary collaboration between different stakeholders is essential. Since decision-making in conservation is no longer done in the laboratory only, conservators became aware of the importance of communication skills (Munoz Vinas 2005). More and more contemporary art conservators operate in ethnographic and archaeological-like disciplines in which the values inherent in the objects are explored by consulting professionals from outside the conservation profession (Lake 2009). The role of the contemporary art conservator moved away from traditional intervention skills towards the role of a facilitator who should guide the interdisciplinary discussions between the artist, the curator, the museum and whatever conservation discipline is needed. They should be able to oversee the practical problems, be able to oversee possible treatments, engage technical expertise when it is needed and bring the discussions into context (Learner 2009, Laurenson 2006). The new role of a conservator is indeed being that of the advocate for the intrinsic values of a given object with respect to its tangible and/or intangible heritage (Munoz Vinas 2009, Learner and Levin 2009)

During international research projects and conferences on conservation of contemporary art the problems of food-based works were highlighted. The variability in these works was clearly underlined, but it became clear that the conservators were still struggling with the preservation of those perishable materials. Instead of focussing on the role of food science, they searched for alternative solutions to conserve the ideas of the physical artworks. This PhD research tried to answer the questions about the conservation of food based art by evaluating the possibilities and limitations of the application of food preservation science.

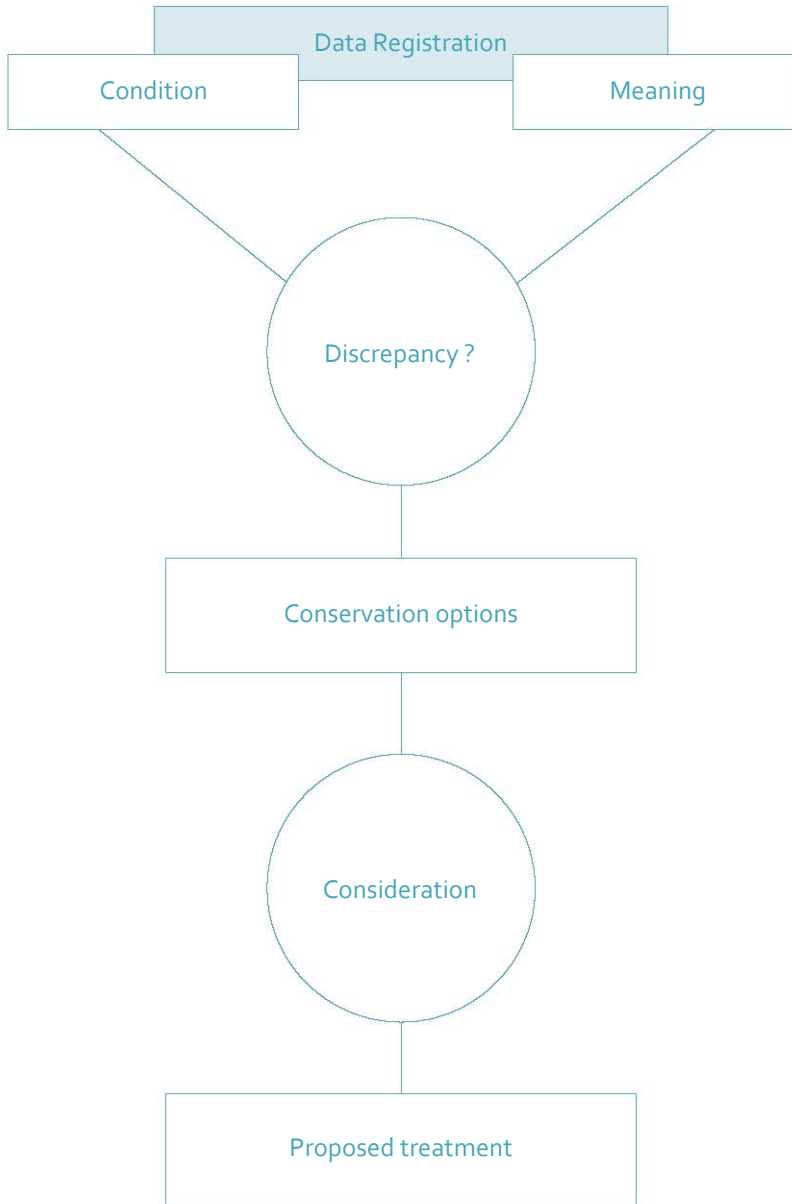


Fig. 6 Decision-making model for the conservation and restoration of modern and contemporary art, Foundation for the conservation of modern art 1997/99

## Chapter 2. Framing food in an art historical context

### 2.1. Introduction of food materials and the study of materials in contemporary art

In the early 20th century, avant-garde artists rejected the traditional use of materials as a reaction to the 'Art for Art's sake' principle. In the course of the 20th century, the expansion of the artistic media and materials was enormous. Artists redefined the conceptual boundaries of art, by using new formulations for, as well those new materials, as the more traditional ones. For instance, Pablo Picasso (1881-1973) used traditional materials, such as oil paints on canvas or on board and introduced ready-made objects, old theatre tickets, strings, pieces of rope and bits of paper into his pictures. Marcel Duchamp's (1887-1968) produced ready-mades, such as *Chocolate Grinder* (1913, Philadelphia Museum of Art, an actual kitchen tool for grinding chocolate, displayed as a work of art) and the scandal evoking ready-made *Fountain* (1917, porcelain urinal laid on his back, copy, 1964, Tate Gallery) (Hopkins 2006). The Russian artist Naum Gabo (1900-1977) was one of the first to use synthetic materials to produce his work. In the capitalist society, industrial materials, such as steel or plastic, became useful for certain artists. Other artists reacted to the ways of the industrial nations and their products, and started to make their artworks out of cheap or poor materials like coal, felt, straw, earth, fat or wax. Especially in the 60s and 70s, there was an explosion of new materials. Fluxus, arte povera and pop artists searched for new anti-museum expressions, by introducing the everyday into art and by using new materials, such as garbage, food, newspaper clippings, cigarettes, etc. More and more, artists became interested in creative freedom and experimented with different ways of producing art. For instance, Fluxus-related objects interrogated the nature of art and rejected the notion that art is a medium for an artist's ego, by creating collaborative artworks (Zycherman 1995). Pop artists questioned the cultural, institutional and discursive frameworks, in which production and reception of art took place, by introducing materials from the everyday life. Artists drew on pictures and objects from mass culture, such as Andy Warhol's (1928-1987) Campbell soup, Corn Flakes and Coca-Cola, repeated to infinity, as a response to the obsessive practices of the consumer driven American popular culture. From Duchamp to pop art, artists produced their art with all kinds of objects from the consumption society. Ready-made techniques showed that one could make everything into an art object (Groys 2002).

The use of ephemeral and food materials became important in these new art forms and began to be employed in a quite unprecedented way. Some artists were intrigued by the formal and functional possibilities of the materials and, they showed a growing interest in the material properties. Rather than functioning just as a matter for the artist's aesthetic expression, those materials generate associations themselves. The growing fascination for materials in artist practices led towards the study of artist materials in art history. Several art historians and theorists discussed contemporary art materials throughout an iconological approach (Thompson 1998, Wagner (1998-2001), Wagner 2001, Van de Vall 2001, Coopman 2001, Van Saaze 2001, Wagner and Ruebel 2002, Wagner et al. 2002, Ruebel et al. 2005, Schummer 2003 & Hackenschmidt 2005). When unstable and amorphous materials gained a programmatic meaning and form, they were no longer regarded as the invariable outcome of artistic expression. The expression itself could then be recognized as the result of certain material qualities (Hackenschmidt 2005). In the context of this PhD research, the publications and research by art historian Monika Wagner are worthy to mention, as she developed a completely new approach in understanding the use of new materials in modern and contemporary art (Wagner 2001, Wagner and Ruebel 2002, Wagner et al. 2002, Ruebel et al. 2005). Wagner addressed the question of why certain materials were already assessed in extremely contrary manners during the 19th century and, she investigated how these assessments continue to have an effect today. In 1996 *The Archive for the Research of Material Iconography* (website Archiv zur Erforschung der Materialikonographie) was established under her supervision at the University of Hamburg, containing the *ABC des Materials (Alphabet of Materials)*, a collection of little pamphlets, each devoted to a single material and the *Picture Archive*, in which colour reproductions of artworks have been filed. Under more than 50 keywords, provided by the applied materials such as air, food and other non-traditional materials, the meaning of the materials used in the 20th century art is documented (Wagner et al. 2002).

The study of materials via iconology can be useful to give insight towards certain 'meanings' of materials. The significances of food in contemporary art became the specific focus of investigations by art historians Raap and Beil. The journalist Jürgen Raap edited a document about 'Essen und Trinken' for the art magazine *Kunstforum International* (2002), in which he gives an overview of the iconology of food as a material. In this document, the social and cultural history of dinner table arrangements and the use of food by Warhol, Roth, Maciunas, Spoerri, Beuys, Delvoye, Broodthaers,

Oldenburg and Dali among others is described and ordered by the materials. The book *Künstlerküche: Lebensmittel als Kunstmaterial-von Schiele bis Jason Rhoades* by Ralf Beil (2002) gives an eloquent description of food representations by contemporary artists. Beil is looking toward the use of real food as an art material and, he interconnected the use of it through all eras of the 20th century. Artists, such as Salvador Dali, Andy Warhol, Pierro Manzoni and Marcel Broodthaers, were used to discuss iconology, as through their works and their use of food materials, the specificity of these artists' personal vocabulary became clear. Those iconological studies contributed to the understanding of the use of food in contemporary art. Therefore they were consulted throughout this chapter, but it appeared that they were insufficient to study the conservation of food-based contemporary art.

In the framework of this study in conservation, it is required to study the use of food materials in contemporary art via the interpretation of their historical context, including an exploration of values inherent in the object, such as the artist intention and the tradition in which the work was made as a reference (chapter 1). The motivations of the artists using food are different for each of them and consequently, the use of food are part of a personal vocabulary of the artist, even when they employ the same food materials. Artists selected, and still do select, diverse methods and different food materials for creating their very diverse works and, they equally assign a unique 'meaning' towards their materials. 'Real' food materials started to be incorporated in sculptures, installations, happenings, performances and environments on a more conceptual and intellectual level. Typical for this demarche is that food materials (with their allotted properties) not only concern the physical appearance of the artwork, but also the semantic net attributed to the food (Van Damme et al. 2006). Eating, feeding oneself, ingesting food and the sensory appeal of the ingredient was raised to the status of art by artists for different reasons.



Fig. 7 Salvador Dalí:  
*Retrospective bust  
of a woman*, 1933,  
private collection,  
Belgium.

One of the first artists who used 'real' food in his works was the surrealist Salvador Dalí (1904-1989). In his artistic practice, he often depicted bread loaves. In some of his objects, he introduced 'real' loaves of bread (Figure 7), exemplifying creative freedom and taking anarchy to an artistic extreme. The history of bread is laden with meaning from Egyptian and Roman paintings onwards to the works of Dalí and others (see below Piero Manzoni and Daniel Spoerri). For instance, the presence of bread is not hard to interpret for anyone familiar with the rudiments of Christianity. Bread appeared frequently on old master's paintings. 'The Last Supper' has for instance been a subject of predilection for a large

number of artists, who produced extremely intense versions of this theme. In the history of food-based art, such representations require a deeper knowledge of the symbolic. Food was often presented as a code, which formed a real tissue of myths, legends and religious beliefs (Van Den Abeele & Van Durme 2007). Although, the historical 'meanings' of bread can be connected to Dalí's use of bread, he established the concept of the *Dalinian Bread* as a personal device, to become an object of mass consumption.

Dalí did not only produce bread-related artworks, but also reflected on his use of this specific material in many writings, in which it became clear why he claimed bread as his primary material. Dalí remained faithful to the idea of bread, after he sought an object or symbol that embodied a number of issues that preoccupied him and other surrealists. In his autobiography *The Secret Life of Salvador Dalí* (1993) he described the moment when he claimed bread as an obsessive material: *I had eaten my fill and was looking absentmindedly, though fixedly, at a piece of bread. It was the heel of a long loaf, lying on its belly, and I could not cease looking at it. Finally I took it and kissed the very tip of it, then with my tongue I sucked it a little to soften it, after which I stuck the softened part on the table, where it remained standing. I had just discovered the enigma of bread: it could stand up without having to be eaten! This thing welded to the idea of primary utility, the elementary basis of continuity, the symbol of 'nutrition', of the sacred 'subsistence', this thing...I was going to render useless and aesthetic.*



In his *Secret Society of Bread* he raised issues regarding consumption in relation to the access, waste and distribution of food. In the early 1930s, Dali described a plan for a happening or performance or environmental art, where the idea was to bake colossal loaves of bread and leave them in various elite spots in Paris and New York. This idea was never realized, although he managed to find a baker equipped to carry out this project (Pine 2010). According to Dali, the bread of Paris was no longer the bread of Paris. It was his bread, Dali's bread, Salvador his bread. Dali's choice of bread points to an acute awareness of the artist's personality and his insistence upon the most basic staple of Western diet points to his populist approach to art-making (Pine 2010). By analyzing the overall context of Dali's bread, the meaning of his bread-related artworks became clear. As contemporary artists attributed new values towards their materials and used them in different ways, it is required to research each artwork case by case before developing a conservation strategy.



Fig. 8 Andy Warhol: *Campbell*, 1962, MOMA, New York.



Fig. 9 Piero Manzoni: *Artista di Merda (Artist's Shit)*, 1961.

For instance, Andy Warhol's Campbell's soup cans had a personal significance. Warhol stated in *I'll Be Your Mirror: The Selected Andy Warhol Interviews: 1962-1987* (2004): *Because I used to drink it. I used to have the same lunch every day, for twenty years, I guess, the same thing over and over again. Someone said my life has dominated me; I liked that idea.* Warhol was one of the first to explore the boundaries between high art

and mass culture with his tins of *Campbell Soup* (1962, Museum of Modern Art (MoMA), New York) (Figure 8) and *Brillo Boxes* (1964, plywood boxes with serigraph and acrylic, National Gallery of Canada). He articulated the form/content relationship in favour of the former (Hackenschmidt 2005). Warhol was interested in packages and containers as things that were first removed from a purchase and then thrown away. They were items with 'sales force' and, therefore became excellent examples of coordination between advertising and packaging (Groys 2002). Also, these works appealed to Warhol's interest in graphic representation. The basic design of the labels became classic and were a superb example of conveying information through the minimum of visual means. The fact that Warhol was trained as a graphic artist was one of the reasons why he appreciated the ability to convey a message with this minimum of visual means (Varnadoe 1993). Pierro Manzoni (1933-1963) brought the dimension of Warhol his art making to a higher level, by emphasizing content and materiality. For his *Merda d'artista (Artist's Shit)* (1961, 30 g, cans of excrement, edition of ninety cans, signed and numbered) (Figure 9), Manzoni calculated the value of the ninety cans in accordance to the daily exchanges for gold. He offered his own 'body' (in the form of his excrements) as an artwork, where the transfigured body became precious relics. His aim was to create a work that spoke of art and its consumption. He parodied the blind trust in consumer products whose real contents were unknown, by providing an accurate description of the content on the containers (Beil 2002).

New materials, such as those used by Warhol and Manzoni, might be composed out of known cultural properties, but also yielded new interesting 'mixtures of properties' (Schummer 2003). Indeed, Warhol his artworks became historically important, as the 'materials' he used refer to this mass consumption culture. Those materials and the 'patina' they obtained remain essential aspects, as they became relics of that culture. Although, the cans and boxes appealed to Warhol's deep design sensibility and to their infinite reproducibility, they also had a deeply personal association for the artist. In the case of Manzoni's use of faeces, the novelty of materials such as 'bottled' faeces, excludes his material from any kind of symbolic or cultural context (Schummer 2003). At that time, the use of faeces and rubbish in avant-garde art used to be subversive, provocative, shocking and revolutionary. Furthermore, the artist also attributed a personal significance towards his material. With this work, he reflected on the role of the artist's body in contemporary art (Beil 2002). By giving new value to these materials, those artists gave thus new meanings to their materials.

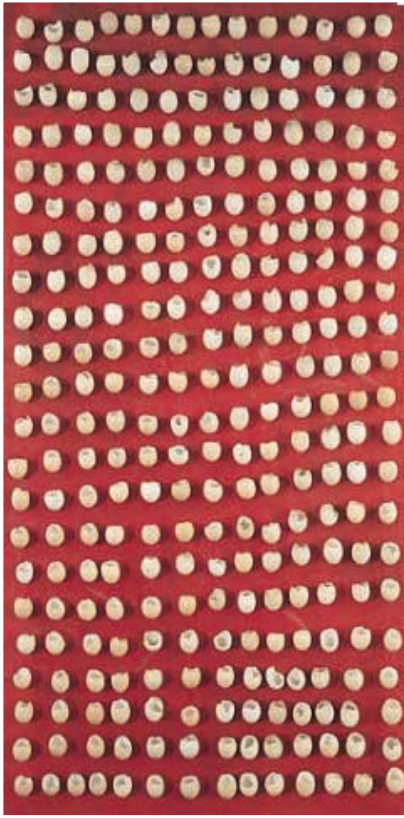


Fig. 10 Marcel Broodthaers: 289 coquilles d'oeufs, 1966, S.M.A.K., Ghent.

ure 10) and repetition of mussel shells, such as with *Grande Casserole de Moules* (S.M.A.K. 1966). He brought those natural materials from the 'real' world together with abstract shapes from the art world, by using those shells, as a medium to cover a surface, in the same way a painter might covers a surface with paint. In many works, he used these materials to cover flat wooden surfaces of simple, geometrical shape. Important here is that the mould or shell became central to Broodthaers' practice and, Belgian references underlie his choice of materials (Schultz 2007). Also, the empty egg shells as a medium to 'paint' refers to the egg tempera, which consisted of a mixture of dry pigment with egg yolk and water, used by the Flemish primitive painters to paint on wooden panels. Egg tempera was characterised by its resistance to being blended, resulting in layer upon layer of hatched brushstrokes (Bradnock 2004). Furthermore, he used empty egg or mussel shells as metaphors of the 'empty' work of

One striking feature in the work of several artists from the 1960s had been the careful attention to formal and material decisions not as an end in itself, but as a means of addressing a wide range of cultural and personal references. Art historian, Jon Thompson (1998) interpreted the use of materials, such as the mussels and eggs in Marcel Broodthaers' (1924-1976) oeuvre as an allusion to the difference between French and Belgian cuisines. He argued that, throughout Broodthaers' work, the use of mussels (as symbols of the Flemish kitchen) and eggs (as raw materials of the Walloon cuisine) were interchangeable metaphoric and metonymic elements (Thompson 1998). Broodthaers highlighted the natural processes of reproduction and repetition in eggshells, such as with *289 coquilles d'oeufs* (S.M.A.K. 1966) (Fig-

art, which always took over the meaning of the museum context. With his work, Broodthaers offered a variegated reflection on the society, on the museum, on the work of art, and on the wider meaning of the concept of art in general (Wittocks 2006).

The semantics of materials are not always available to visual perception alone and, one may thus need to know an artist through his specific vocabulary. According to Wagner (2001), it is not only the material properties that are pivotal to understand the artwork, but also the different ways in which they were utilized in the process of artistic creation. Wagner (2001) researched to what extent artists of the 20th century used and, she avoided certain ascriptions towards their materials. To understand the works, one should indeed be familiar with the particular interests and associations of artists. For instance, the fragile eggshells, used by Broodthaers, were obtained from one particular Brussels cook, as he liked the way she cracked them. He was amused by the contrast between the shells, being protected behind glass and, by the presence of the shells on the table that could easily be damaged. A mussel for him was perfect, because it was self-containing, as it was both a mould and a cast, referring to the archetypes containing all possible sculptures (Schultz 2007). Broodthaers tied up the mussel and eggshells in a complex network of meanings, by giving them references that were linguistic, as well as formal, content-specific, historical, and conceptual in nature.

Artists have produced an increasingly large body of works that cannot be understood in isolation, because the overall context in which they were made is intrinsic to the work. Whereas art from the early 20th century could still be understood according to certain movements or categories, artists from the 1980s and 1990s picked and chose different kinds of materials, combining them with other elements, associated with many different movements. This presents widely diverse visions from artists and, very diverse meanings they attributed towards their works of art.

## 2.2. Eat art outside the museum

A real shift in artistic practices was brought when ephemeral art was created outside the museum, in a sphere of anti-establishment and anti-museum in particular (Wharton & Molotch 2009). Ephemeral food-based art often became a strategy to avoid commercial mechanisms of the art market and related institutions. In 1930, Marinetti's (1876-1944) *Manifest of Futurist Cuisine* contributed fundamentally to the relationship between art and food. He set out rules for a futurist cuisine, as he wanted life

and art to coalesce, food to become art and, artworks to be eaten. His presentation of food was meant to stimulate the desire throughout the creation of flavourful, colourful and tactile substances. Dining became a purely aesthetic enterprise (Groos 2009). Marinetti's 1932 manifesto declared war on pasta and, he demanded that eating became an ecstatic experience (Kennedy 2007). By introducing banquets, perceived to be a 'total work of art', Marinetti understood futurist cuisine to be a political statement and, he understood his art making as a conscious reaction to the world economic crisis of that time (Groos 2009). Although, the futurists advocated the abolition of eloquence and politics around the table, the guests first had to sit through a lecture by Marinetti on the state of world futurism 'Eat Art'. The formula 'Art = Life' was for the first time introduced by the Futurists in 1931, as a new form of artistic practice in the history of modern art. Afterwards, Gordon Matta Clark (1943-1978) and Daniel Spoerri (1930) further explored this artistic practice, although with different objectives. The approach to borrow a term from marketing opened up new possibilities to art production.

In the late 1960s, the politics and social climate encouraged a new generation of artists, whose dematerialized art couldn't find a compatible home in the commercial galleries and the closed circuit of the museums. At that time, artists questioned the traditional framework of museums and, they began to produce immaterial process-based artworks. This led to the development of alternative new places to exhibit, research, perform and share ideas for how to live, work and show their art (Becker 1982, Davidts 2006). Artists joined forces and located alternative spaces, which they cleaned and renovated to show their work. These spaces between 'art and life', in which food and eating played an important part, became the perfect workshops for site-specific, performative and non-material creative adventures. Most of the works were created collaboratively, often spontaneous and open-ended. Those works were improvisational with the intent to create an experience, which existed only within a given time frame. But, a lot of the artists documented their works as a result or memory of the 'happening'. Those artists became a generation in transit and questioned the established institutions, by initiating constructive change, which became clear in the next decades (Apple 1981).

Gordon Matta Clark (1943-1978), perceived as one of the most influential artists of that time, played a vital role in the creation of those 'Alternative Spaces' and contributed to the mythologizing of New York's SoHo of the seventies. His 'restaurant-and-artwork' *Food* (1971-1973), realized in collaboration with Caroline Goodden and many others, still continues to

challenge the categories of art, by calling into question issues of authorship and historization (Bußmann & Müller 1999). Such performance-based works cannot be attributed to one distinct author, as they were the result of complex collaborations between various participants, often including the audience. Gordon Matta Clark was often the initiator of those performances and therefore, most of them are presented as Matta-Clark's work. Projects, such as *Food*, reflected on art history and on the museum as an institution that generates genealogical-historical taxonomies. *Food* questioned these taxonomies as well as the museum practice in general. Matta Clark worked on the borderlines between art and architecture, museum and public space, urban space and private space and art and life. The restaurant *Food*, as a collaborative enterprise, was perceived as a place that would nourish other artists and visitors with more than just the food. It could be interpreted as one big artwork, which was documented by a film, photographs and ads in the art magazine *Avalanche* (1968) (Davidts 2006). *Avalanche* was founded by Liza Béar and Willoghby Sharp, which documented the activities and personal lives of the artists living and working around 112 and *Food*. Those 'going-ons' were recorded throughout the magazine, often with small notes and printed interviews with Matta-Clark and Girourard (Morris 1999). Matta Clark could never quite distinguish his culinary passions from those of art making, with bizarre dinner parties as result. Artists stood in as guest chefs and cooked in a kitchen that was fully open to the dining room. They cooked inedible meals or served sushi and sashimi, featured ceviche, borscht, rabbit stew with prunes, stuffed tongue Creole, etc. One of the most fabled dinners was Matta Clark's *Bone Dinner*, which featured oxtail soup, roasted marrowbones and frog's legs among other bony entrees. After the plates were cleared, the bones were scrubbed and strung together, so that the guests could wear their leftovers home. Such meals were at that particular time in New York not common, but were the perfect expression of a counterculture that influenced and changed mainstream culture. Cooking became a kind of performance and, the restaurant established itself as a 'perpetual dinner party'. Conceptually, this idea was important as a food-based philanthropy that would employ and support struggling artists as a living, breathing and steaming artwork (Kennedy 2007).





Fig. 11 Daniel Spoerri: *Tableau Piège*, 1971, S.M.A.K., Ghent.

In the beginning of the 1960s, Daniel Spoerri (1930) also explored the concept of a restaurant as an artwork within the circle of the European artist's group known as *Nouveaux Réalistes*. He was an obsessive collector of cookbooks and was especially interested in the histories of cultural developments of cooking and eating habits (Morsbach 2009). Spoerri cooked and served meals in a Parisian gallery in 1963. Not only did the gallery visitors become true consumers in this way, but Spoerri also glued the remains of the meal and leftovers from the table after

every dinner. In a way, he reinvented the still life by fixing this moment of life as a three-dimensional 'wall painting' (Buschmann 2010). The core elements of these fixed meals were his irritation and questioning of eating habits in the consumer society. By mystifying dishes, reversing menus, interrupting conditioned behavioural patterns, he wanted to know how it came to such a disorder at the table (Morsbach 2009). The origin of his so-called *Tableaux Pièges* (1960) (Figure 11) had a close connection to Duchamp, who no longer turned the attention to the visual representation of an object but was more interested in the use of everyday objects.

In 1968, Spoerri opened his *Restaurant Spoerri* in Düsseldorf where he continued working on his *Tableaux Pièges*, becoming successful with his unconventional cuisine. He developed the restaurant into a gathering point for all those who sought a culinary experimental laboratory and continued inviting several artists to cook. Quite wealthy people frequented this place, participated in his 'Eat Art Banquets' and collected his art. Two years later, Spoerri put the *Eat Art Gallery* into operation and established the term Eat Art, outlining his motivation that would solely concentrate on the artistic-sculptural deployment of foodstuffs. Daniel Spoerri questioned eating habits in the consumer society through the obfuscation of dishes and the reversal of the menu order, which were the core elements of the remains of meals fixed on the tabletops. He recognized how important these subjects were to him and named it as a

slogan 'EAT.ART' (Morsbach 2009). He quoted (Spoerri 2009): *Then there comes the Eat Art, not the cooking art. Our grandfather Marcel Duchamp used to say: 'The viewer completes and terminates the picture, the work'. So one could say that the eater is the purpose of cooking and not the cook! The degree to which he digests it, how it tastes to him, appeases his hunger, or how it burdens and hampers him through indigestibility and tastelessness so good or bad is the cook! ... What interests me is the question as to what one can eat, the whole range of issues from malnutrition whether personally intended or externally imposed all the way to overeating whether arising out of intemperance or disease.*

For Spoerri, Eat Art meant cooking and eating as a part of everyday life. He was a kind of gastrosoph, who was concerned with the teachings of the wisdom of cooking. The term gastrosophy (the science of good eating) first appears in 1851 in the book *Gastrosophie oder Lehre von den Freuden der Tafel* by Vaerst. Vaerst described diverse kinds of food and how different countries handle and cook it. In his book, he philosophized about soup and wrote down the history of enjoyment. Today, the term is more associated with a philosophy about 'good dining' and reflects the relationship between the human existence and the world (Morsbach 2009). With his originally concept, Spoerri maintained a unique position and became one of the most famous Eat Art artist (Morsbach 2009).

In the 1960s and 1970s, the production of artworks with ephemeral materials, such as food, took place as part of a radical redefinition of art in which the physical object was replaced by an ephemeral, process-based approach to art-making (Iles and Huldish 2005). The art activities that began in the late 1960s were connected with complex, cultural, social, political and ideological factors and shaped the decade that followed. Art was at that time not primarily concerned with issues of conservation or preservation, as this period was marked by a distrust of institutional control. But, artists clearly demanded a voice in determining how their works were displayed and interpreted. They transformed the spaces of display in order to transform art. They critiqued the traditional rituals of display and concepts such as 'aura' and 'authenticity' (Benjamin 1936). This would later have an effect on conservation and presentation strategies.



## 2.3. Eat art in the centre of museum activities

### 2.3.1. Eat art exhibitions

#### 2.3.1.1 Documentation on display

As mentioned before, in the 1960s and the 1970s, quite a lot of exhibitions were organized into places outside the museum in houses, warehouses or factories (Lamoureux 1996). Movement across borders became key feature of artistic practices, but also of curatorial strategies. The paradigm shift in the exhibition space corresponded to the emphasis placed on the process of art making (Nairne 1996). One of the first who created a 'standard' exhibition with process-based art was Ken Friedman (1949), a member of the fluxus community. Ken Friedman began to meet and work with fluxus artists in the 1960s, after he met George Maciunas and shared his ideas on communal work. He was not really an artist, but the things he did paralleled the activities of the artists and composers in fluxus (Friedman 2008 & Frank 2008). Friedman exhibited core fluxus art by unknown authors, together with artworks from artists who extended and reinterpreted fluxus in universities and libraries. In 1970, Friedman's work resulted in a major traveling exhibition *Fluxshoe* in Great Britain. Several new modes of artworks were visible, including conceptual art, performances, multiples, book art, mail art, body art and stamp art (Friedman 2008 & Frank 2008).

Maurice Tuchman (1936), curator of modern art at the Los Angeles County Museum of Art (LACMA) conceived in 1966 the *Art and Technology (A&T)*, a project in which 64 artists were matched with corporations to work together. Their activities were organized peripheral to the museum activities, but were very significant and groundbreaking in the context of the evolution of exhibitions with ephemeral art. For instance, Tuchman supervised the material achievement from food-based works by Oldenburg and Warhol. In 1969 Andy Warhol was connected with Cowles Communications in New York and contracted with LACMA to create work for The *Art and Technology* program. Claes Oldenburg worked in a studio assigned by Disney. Disney encouraged Oldenburg to make as many drawings and proposals as he wanted to (Crawford 2008). Oldenburg then designed *Giant Icebag* and *Theatre of Objects* or *Oldenburg's Ride*, large series of mechanical sculptures, enclosed in an amphitheatre. Afterwards Disney craftsmen and model builders developed Oldenburg's designs into effective working models. Several 'metamorphic' pieces were included: 'a large undulating green jelly mold, with fruits suspended inside', 'a bowl

of cornflakes and banana slices falling from an inverted disk', 'a plate on which eggs are cracked, thrown, scrambled and then reconstituted', 'a pie case, in which pies would gradually disappear as if they were being eaten, and then be reassembled' and 'a chocolate earthquake made of giant chocolate bars, which would shift precariously, crack open and settle back' (website Media Arts and Technology Graduate Program). He presented work by Oldenburg and Warhol at the 1970s Osaka World Exposition and at LACMA the same year. Some of these sculptures still belong to the collection of Maurice Tuchman (Wharton et al. 1995).



Fig. 12 Interior view Restaurant Spoerri, 1968-1972

The different artistic activities launched by fluxus artists and others became accommodated by the institution. In the late 1980s and early 1990s, ephemeral productions of collaborative art were no longer considered as 'high risk'. On the contrary, they became interesting, as those works revisited an important chapter in art history and consequently their market value increased. Fluxus artists formulated most of the major themes, which were further historicized in the course of the years. These themes became accepted as categories, including: institutional critique, social sculpture and context art. Therefore, art institutions changed their practices in order to collect those ephemeral productions. But, by necessity a lot of the exhibitions displayed various forms of documentations, such as films, photographs, posters, recipes, notebooks, magazines or leftovers. In most of the cases there was no material legacy of the 'original' art pieces, or the physical contours of the work had been altered. This was certainly the case for a lot of food-based artworks. Certain kinds of information were related to a work's provenance, such as

the documentation of performances and events in *The Shop* (Oldenburg), *The Factory* (Warhol), *Food* (Matta Clark) and *Restaurant Spoerri* (Spoerri) (Figure 12.) made by the artists themselves (Buskirk 2005). The fact that this archival material was often viewed as unconnected to a work's meaning resulted in exhibitions that were more a form of urban and art historical archaeology. Furthermore, American art institutions set up a new trend that allowed temporary works created in the 1960s and 1970s for specific places, to be reproduced for the sake of visibility. Several works by well-known artists began to be recreated as 'new originals' in high profile exhibitions. Under new narratives, ephemeral art became legitimized as fit for the museum (Hapgood 1990).

One of the first retrospective exhibitions, showing ephemeral artworks with food, was the exhibition *Alternatives in Retrospect: An Historical Overview 1969-1975* held in New York's *The New Museum's* young history. This exhibition, curated by Jackie Apple, was organized to preserve the ideas and concepts of site-specific, process-oriented and performance based works that no longer existed (Tucker 1981). It included different forms of documentation from collaborative projects and, it even included recreated installations and performances by Gordon-Matta Clark and other artists with whom he cooperated. The choices of reinstallation and reconstruction were based on works, which closely represented the aesthetic concerns and philosophical positions and, which were attributed to the most active participants. In that sense, *Alternatives in Retrospect* can be interpreted as an archaeological expedition, in which the works had been excavated and restored (Apple 1981).

Over the years, the institution learned to question its code via confrontation with the quite tangible everyday reality. The topic food and art engendered more and more a strong interest, particularly by an international scene. Also, more recent Eat Art exhibitions highlighted ideas and concerns of a generation of artists, for whom the topic food engendered a manifestly strong interest, by focusing on retrospective components. For instance, during the exhibition *FOOD: An Exhibition by White Columns*, curated by Catherine Morris in 1999 in New York, Gordon Matta Clark's *Food* project and the projects related to it were shown by various forms of documentation and work-materials: the three film reels featuring Matta Clark's unfinished *Day in the life of Food*, the art magazine *Avalanche* (that featured interviews, listings and descriptions of the performances and openings) notebooks with ingredients and recipes, announcement posters and photos of the restaurant and their activities (Bußmann & Müller 1999).

From the 1990s onwards, an even wider range of artists turned to the topic 'food' and have adopted and extended themes of Eat Art. They reflected on social conditions through the use of food as sculpture, installation, performance and the direct intervention of the body. Those artists took the process from previous generations for granted and rather experimented with the materials. Nevertheless, the exemplary nature of the works by Daniel Spoerri, Gordon Matta Clark, Joseph Beuys (see part 3) and Dieter Roth (see below) remained unquestionable in this, making it easy to see the link with the work of younger creative artists. Clearly, from the 1960s and 1970s, artists included a desire for gastronomic conviviality and, they tried to give the work of art a new definition. Some artists interpreted the cooking process as an alchemic process, in which the trivial materials were transformed through creative actions and then offered to the public for consumption. In that way, consuming an artist menu could be interpreted as the intake of material nourishment that is transformed into spiritual energy (Van Damme et al. 2006). Furthermore, such artistry could be traced in events organized in the restaurant of the Museum of contemporary art in Ghent (S.M.A.K.). In 2000 Jan Hoet (1936 – 2014), the former director of the S.M.A.K., invited artists, familiar with the use of food materials in their works, such as Peter De Cupere (1970) and Wim Delvoye (1965) (see part III) and several other artists, who were less familiar with working with food, to cook their favourite meal for a group of people with the intention to engineer discussions. Through this kind of events, Hoet offered a platform where artists and the public could foster an interactive relationship and discuss food-based art related themes (Hoet 2000).

### 2.3.1.2 'Real' food-based art on display

In 2004, a few institutions organized 'Food exhibitions'. Instead of producing site-specific, ephemeral art outside the museum, more and more artists were asked to create performances, happenings, installations for specific exhibitions in the art institutions. All those 'new media' artworks were held throughout museum activities, evolving all the way to participatory concepts, such as cooking actions inside the museum, which was in clear contrast with several artists of the past.

For the exhibition *Hors d'oeuvre: Ordre et désordres de la nourriture* (CAPC, Musée d'art contemporain de Bordeaux, 09/10/2004 – 13/02/2005), Rirkrit Tiravanija (1961) created a new performance-based work, as he cooked a Thai meal during the opening evening. Afterwards his wooden kitchen construction with leftovers of the meal functioned as an installation during the continuation of the exhibition. The culinary

actions from Tiravanija were, and still are, mostly activated through the public's presence; sole parameter to give the performance real meaning. By serving food, the artist shortens the gap between art and life while at the same time acknowledging the boundaries of the context in which he cooks. Through the experiences of pleasure and conversation, the question of the meaning of art in society arises indirectly. Cooking is at the fore, but the background deals with the issue of the museum as a place that is becoming more open for societal participation. Tiravanija shares, with the previous generation, the building of a new relationship with the visitor, based on sharing and conviviality, by making food and its preparation as a real artistic issue. The spaces the artist put at the public's disposal and the events that take place there could be placed in parallel with the openings, carried out by fluxus artists or by personalities, such as Manzoni (Fréchuret 2004). Aside from the installation as a temporary restaurant, other references to Eat Art appear in his art. Mostly, he leaves the leftovers from his eating events in the installation, which are a variation on the *Tableaux-Pièges* by Daniel Spoerri.



Fig. 13 Sonja Alhauser: *Chocolate Machine n°2*, 2000, collection of the artist.

Also, the video-work *VB52* (2003, Castello di Rivoli Turin) by Vanessa Beecroft (1969), presented during this exposition, refers to the works of old masters, as it could be interpreted as a real 'tableau vivant' of *The Last Supper* (Van Eyck Brothers, Ghent). In Beecroft's performance (presented as a video) actresses took place along the sides of a large glass table in a specific order: from the oldest to the youngest, reinforced by the choice of colours and the lightness of the clothing. During this five-hour duration event, a meal is served, in which

the different courses follow on from one another, according to a protocol based on colours. The performance was structured by a sequence of courses that is represented by a series of colours: white for the first courses, then green, red, orange etc. (Fréchuret 2004). The sculpture *Chocolate Machine n°2* (2000) (Figure 13) by Sonja Alhauser's created a sensual experience during the exhibition by Fréchuret, triggered by the smell of liquid chocolate. She invited visitors to break off pieces of her sculpture, to smell and taste the chocolate. For Alhauser, the works cannot evolve without the completion by the audience. Here, the audience was really needed to help to fulfil work. She casted the chocolate

parts at the museum a few days prior to the opening, because her installations need to be fresh. She always produces her works with high-quality ingredients and even gives them expiration dates, to prevent spoilage. By the end of the exhibitions, only photographs documenting the consumption of the work remain. The photographs are in a sense 'recipe paintings' and imply that her work could be remade, according to the visual instructions. Her physical sculptures need to be eaten and not 'collected' (Peacock 2006).

Through the works by Tiravanija, Alhauser and also through one of Felix Gonzalez-Torres' candy piles (see below), the idea of consumption was physically enacted in the exhibition room. By connecting the museum with a space for consumption, the visitor is confused. By focusing on the works and their materiality, Maurice Fréchuret, the curator of this show, rejected the usual classifications that turned works into witnesses of a specific generation or style. Fréchuret revisited the roots of the food-based contemporary art, by presenting works by Man Ray, Dali, Warhol, Manzoni and Spoerri. The typological schema he chose for the exhibition provided a frame of reference, on which it was possible to base a history of works. New was that he did not only focus on the historical situations in which those works were created, but also paid attention to artists' intentions. Fréchuret acknowledged the motivations for experimentation by Tiravanija, Alhauser and Gonzalez-Torres and, he understood the meaning embedded in their work (Fréchuret 2004).

Together with the thematic food exhibitions, diverse accompanying lectures, debates and conferences contextualized the theme of food-based art. During *Hors d'oeuvre: ordre et désordres de la nourriture*, a 3-day conference *Scènes de Table* lectures was organized, held by anthropologists, sociologists, historians, psychoanalysts, musicologists. Also, during the food exhibition *Das Große Fressen: Von Pop bis heute* (25/01 – 24/04 2004) in the Kunsthalle Bielefeld, events and lectures by chefs, gastrologists, writers and journalists were organized in collaboration with the Institut für Wissenschafts- und Technikforschung at the University of Bielefeld. During this exhibition, the foyer of the Kunsthalle was transformed into a temporary studio kitchen completed with a coffee bar. This exhibition, also conceived as an anthology of historical and contemporary works, contained works from Andy Warhol, Claes Oldenburg and others that represented the historic pop art, exemplary works by Dieter Roth and Joseph Beuys and works by younger artists, such as Jason Rhoades (part 3), Robert Gober (next chapter) and Damien Hirst, among others (Kellein and Lampe 2004).

That same year, the retrospective aspect, in combination with contemporary artworks, was also the focus of the exhibition *De Gustibus... Rond eten in de hedendaagse kunst* (Broelmuseum and ING Kortrijk 14/02-29/04 2004). This exhibition showed traditional paintings and still lifes from the museum's Fine Arts collection, alongside with works by Belgian and international artists on the subject of 'eating and food'. A number of food themes and topics were stipulated in this exhibition: taste and connoisseurship, the social function of eating, the ritual commensality, the beauty and transience of food and the consumption and digestion of food. Sculptures and paintings by Spoerri and Beuys, among other food-based works, were on show next to some more interactive works, such as the mobile cooking by Dupuis & Baensch (Van Den Abeele and Van Durme 2007). The performance project *Kitchen, la cuisine transportable* by Thorsten Baensch (1964) and Christine Dupuis (1946) was founded in 2001. The mobile kitchen, in the form of a cardboard construction with paper-plate drawings, recipes, notes etc., acts as a backdrop for the artists to barter soup, tea and marzipan in return for visitors' personal recipes or drawings (Van Den Abeele and Van Durme 2007).

In 2005, The Museum Ludwig in Cologne initiated and coordinated the exhibition *Chocolate Art* on two locations. In the Ludwig Museum itself, the main emphasis was on artistic works from the museum's permanent collection and new chocolate artworks by well-known contemporary artists (among them: Sonja Alhauser) realized in collaboration with a chocolatier and museum professionals from the Cologne's Chocolate Museum. In the Chocolate Museum (Imhoff-Stollwerck-Museum), the exhibition focused more on culture historical aspects and on the material chocolate itself. Also, both museums launched small-multiplied artworks, especially created for this exhibition, onto the art market (König et al. 2005). This collaboration, between the artists and the industry, recalled the collaborative work of fluxus artists.

Also, the exhibition *Eating the Universe: Vom Essen in der Kunst* for instance (Kunsthalle Düsseldorf, 28/11/2009 – 28/02/2010 / Galerie im Taxispalais Innsbruck, 24/04/2010 – 04/07/2010 / Kunstmuseum Stuttgart, 18/09/2010 – 09/01/2011) included a retrospective component, by approaching the theme of food and eating in art from a cultural-historical perspective and included a lot of works by contemporary living artists. On the one hand, this exhibition revisited an important chapter in the history of the Düsseldorf art scene, by presenting documentation of the performances and other food-based works by Beuys, Spoerri, Gordon Matta Clark, Dieter Roth and others. On the other hand, the



themes of Eat Art, addressed by contemporary artists, characterized by a fundamental openness for the existential questions on current social and human conditions, were involved in this exposition, such as the work *Das Kleine Willkommen (The Small Welcome)* (2009) by Sonja Alhauser. This sculpture contained a statue modeled out of butter, which fitted into a display refrigerator. Also, in this case, the artist Rirkrit Tiravanija created a performance-based work, especially for this show, in which he cooked meals at the opening. Also here, the leftovers were displayed and functioned as an installation during the rest of the exhibition (Buschmann et al. 2009).

Definitely, food exhibitions evolved during the years and became hot topic. More and more, museums solicited contemporary food-based artworks and, they searched for ways to acquire, manage and preserve those ephemeral, process-based artworks.

### 2.3.2. Collecting food-based art

Traditionally, ephemeral art with food was considered uncollectable. Artists, creating their work in the 'alternative spaces', raised money from private sources, in order to maintain these places and manage their work. The critique on institutional definitions and conventions were an important aspect of ephemeral works, being created at that time. During the years, these artists helped establish the possibility that an ephemeral installation might be defined as a work of art (Buskirk 2003). As many of those works were never intended for institutional display, they were certainly not intended for conventional collecting. Only a few dealers dared to venture artworks made in the alternative spaces, such as the Paula Cooper Gallery in Soho (1968, New York) (Delahoyd 1981). Such galleries also helped to establish ephemeral art, as being collectable and challenged the museum institutions to be more inclusive by soliciting such artworks.

Definitely, at first, fluxus-related artists were against the art object as a non-functional commodity to be sold and, they stood in direct opposition to the institutional basis of art itself. In the 1960s, fluxus was treated as marginal and, the goal of most multiples was to appeal to popular demand, through low prices and the toy-like nature of many editions. A few fluxus artworks had been exhibited in conventional art galleries in the early 1960s. In the 1970s, new multiples were created and older multiples were still produced on demand. During this time, fluxus performances regained their prominence. In the 1980s and 1990s, new and recreated



performances appeared in leading galleries. Ken Friedman worked closely together with Maciunas, Beuys and other fluxus artists and, he created archives and publications in order to document their works. He sold and donated archival material, works and documentation to different collections of universities, museums and banks (the Archive of American Art, the library of the Whitney Museum of American Art, the Franklin Furnace Archive of Artists' Books, the Fluxshoe collection that came from the core of the fluxus holdings of the Tate Gallery in London, the George Maciunas Memorial Collection at Dartmouth College's Hood Museum of Art, Fluxus collection at the University of Iowa's (Alternative Traditions in Contemporary Art collection), the University of California at San Diego, the San Diego Museum of Contemporary Art, the Henie-Onstad Museum at Hovikodden in Norway and the Vancouver's Image Bank) (Frank 2008). At that time, it appeared to be much easier to collect ephemeral artworks, when they were given or bequeathed to a gallery than, when they were purchased (Barker & Smithen 2006). By finding institutional homes for the fluxus material, he intended fluxus to be available to scholars, artists, curators and the public (Frank 2008). Afterwards, the fluxus movement earned a full art historical status. Due to the efforts of Friedman and other important collectors of contemporary art, like Gilbert and Lila Silverman, Jean Brown and Hanns Sohm, and curators Jon Hendricks and René Block, fluxus achieved stature as art suitable for museums. Some critics argued that the aestheticization of fluxus objects has threatened to erase the critical social dimension of the fluxus enterprise. In the rush to exhibit, historicize and theorize fluxus, it eclipsed its performative base and the critical content of fluxus objects themselves threatened to be lost (Zycherman 1995 & Stiles 1991). This was one of the reasons why the conservation of process-based art was considered problematic.

Because of artists' willingness for cooperation in order to cope with the conservation issues, more museums became prepared to acquire food-based art. At first, they acquired such artworks on a documentation basis. Interaction between museum and artists were encouraged by collaborative projects, such as the *Art and Technology* by Tuchman (see above). The LACMA museum held an archive, consisting of documentation relating to this program, including administrative files, correspondence, curatorial notes and drafts of essays on artists, transcripts of artist interviews and, it held some sketches and photographs of artworks, created by the artists-in-residence, including food-based works by Warhol and Oldenburg (website online archive of California (OAC)). At first, museums were still reserved when it came to acquire the food-based works but, more and more, they became aware of the importance of such works. While firstly

the artists themselves documented their process-based art, then the museum started to document these works.

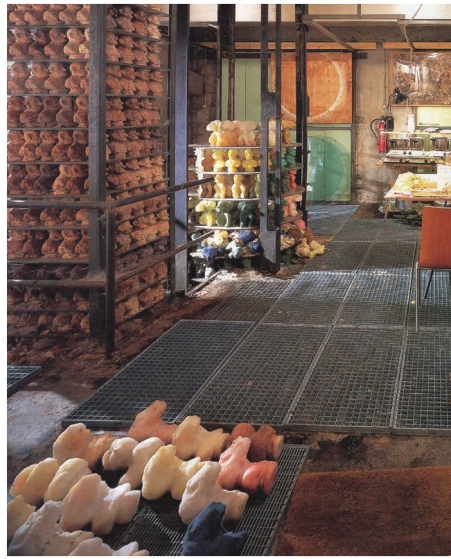


Fig. 14 Dieter Roth: *Zuckerturm and Selbsturm*, 1994/2013, Hauser & Wirth, New York

Some artists established their own museums in order to control how their work could be included into collections. In 1968, Marcel Broodthaers (1924-1976) created his own subversive museum in Brussels in which he performed the different museum roles from director to registrar to curator. *Musée d'Art Moderne, Département des Aigles, section XIXe siècle* is an ironic and subversive mirroring of the museum format, undermining the mental and institutional organization of meaning. Striving towards an artistic

freedom, Broodthaers parodied the control that both, museums and governmental authorities, tried to impose at that time (Marstine 2006). From the mid-1960s, Dieter Roth (well-known for his food-based art, see following chapter) began to devise many different strategies for collecting and archiving his wintended perishable work and, he encouraged collectors to take an active part in the evolution of their holdings. Roth's top priority was to exhibit his work only at venues that accepted his active involvement (Vischer 2004). Roth established in the early 1970s a private museum *Schimmelmuseum (Mould Museum)* and an archive for his work, according to his own ideas, with the support from his Hamburg collector and friend Buse (Dobke 2002). Roth worked on the institutional consolidation of the Dieter Roth Foundation and, he hired Dirk Dobke as curator to manage the documentation. He encouraged the preservation of his food-based work and, he supported collectors and museums with concrete suggestions, such as various forms of record-keeping and archival accumulation. Some of his food-based installations (see next chapter), from his own collection, were remade and were acquired by other museums. The Emanuel Hoffman Foundation in Basel acquired his

food-based installation *Zuckerturm* and *Selbstturm* (*Sugar Tower* and *Self Tower*) (Figure 14), two towers made of figures in chocolate and sugar, to be installed permanently into the Museum for Contemporary Art in Basel. Dieter Roth demanded to have continued access in order to 'manage' his installations. While in the *Schimmelmuseum*, the gradual decay, caused by fluctuations in temperature, the infestation of insects and high humidity, was tolerated, it was not in the museum in Basel. In both cases, the towers collapsed several times. In his own museum, he reconstructed the towers, while in Basel, he stabilized the towers by supports and installed a dehydrate machine. According to the president of the Hoffman foundation, Maja Oeri, Dieter Roth didn't dissociate from his declaration to manifest the degradation, but he took this decision because here the work was installed in a 'real' museum context (Dobke & Walter 2004). Indeed, because of the artist's willingness to cooperate with the museum in the long-term, the museum became less afraid to acquire perishable food-based art.

The acquisition history of some of Joseph Beuys' fluxus-type objects (see also following chapters), by the Tate Gallery in London, uncovered museums' awareness of the conservation and curatorial issues. The manipulation of organic and time-based materials by Beuys intrigued Tate since the 1970s. Tate curators believed that it was necessary to acquire works incorporating his signature materials of fat, felt and wax, in order to represent his work more comprehensively. Over the following years, Beuys' international reputation grew. Major European galleries boasted significant holdings of his work, such as the Wide White Space Gallery in Antwerp, who obtained *Fat Battery* (1963) in 1967 (Barker and Bracker 2005). With *Fat Battery*, containing a cardboard with butter placed in proximity to copper, Beuys created a metaphorical 'electrical charge'. In 1974, Anny De Decker of the Wide White Space Gallery sent some works by Beuys to the Tate Board of Trustees, to consider a purchase. The Board rejected *Fat Battery* and other works by Beuys on the basis of their impermanent materials, which were, according to them, impossible to conserve (Barker and Bracker 2005). Ted Power (the then-Chairman of Trustees) recognized the representational and referential importance of *Fat Battery* to Beuys' fluxus activity and purchased the work. He then offered it to Tate as a long-term loan. In 1984 Tate finally decided to acquire the artist's most current work if Beuys agreed to re-engage with Tate in order to find a consensus on the display of his work. He then offered two more works to Tate, spurring Ted Powers to emulate Beuys' generosity. Also, Beuys bequeathed *Fat Battery* to Tate. He agreed to 're-perform' his work, by assembling different pieces into 3 display-cases.

Since then, *Fat Battery* (Figure 15), displayed as an independent object from 1974 to 1984, was presented in a display case together with other works and, this work was renamed *Untitled (Vitrine)* (1983)(Figure 16) (Barker and Bracker 2005).



Fig. 15 Joseph Beuys: *Fat Battery*, 1963, Tate Gallery, London.



Fig. 16 Joseph Beuys: *Untitled (Vitrine)*, 1983, Tate Gallery, London.

Since the 1960s, institutes gradually integrated ephemeral art in their collections. Art that was opposed to the prevailing systems of the institute became accepted (Lippard 1973). Art of the 1950s, 1960s and 1970s had passed the 'test of time' and collectors were more comfortable buying those artworks. Although, some collectors hesitated to purchase such food art because of clear conservation issues, other collectors, who were more familiar with food-based work, such as Ken Friedman, Maurice Tuchman, Maja Oeri, Ted Powers, Paula Cooper and Charles Saatchi, were more prepared to buy such works (Peacock 2006).



Fig. 17 Robert Gober: *Bag of Donuts*, 1989.

Paula Cooper represented the artist Robert Gober (1954), whose food-based art often misleads the viewer. Gober gathered together elements from different art historical sources such as dada and pop art, adapted aspects of the surrealist and minimalist aesthetics and, he gave his work recognizable features and forms. His works do not mirror today's high-tech world of consumerism, but look more like relics, as metaphors for the middle class world in which he grew up

(website Schaulager). His art deals directly with some major social issues concerning religion, politics, sexuality and gender (Taylor 2005). For example, *Cat Litter* (1989, ink and latex paint on plaster, edition, Paula Cooper Gallery, New York Werner Lippert, Düsseldorf Galerie Max Hetzler, Berlin Private collection and Los Angeles Anon) seems at first sight to be a bag containing cat food, but there is no real 'food' inside. Another sculpture, entitled *Bag of Donuts* (1989) (Figure 17), presents itself as a simple replica of its subject, as the artist treated the donuts. He shipped his donuts off to Germany to receive extensive treatment from Christian Scheidemann to preserve them. The donuts were subjected to a multi stage process, which included degreasing through repeated low pressure acetone baths and refilled them with an acrylic resin for preservation, followed by a coating of cinnamon for aroma and appearance (Buskirk 2003). When Gober created his *Bag of Donuts*, he made his donuts in the traditional fashion by frying dough. In a later stage, he decided to treat them, as he wanted those to exist forever. The 'permanent' donuts remind viewers of the transience that would normally be their fate.



Fig. 18 Sarah Lucas: *Two fried eggs and a kebab*, 1992, Saatchi & Saatchi, London

Charles Saatchi, co-founder of the Saatchi & Saatchi advertising agency, purchased two works by Sarah Lucas (1962): *Au Naturel* (1994), containing a cucumber, 2 oranges and 2 melons and *Two fried eggs and a kebab* (1992) (Figure 18), containing a fried egg and a döner kebab. Throughout her works, she questions the gender definitions and challenges the dominating male culture. As a young female artist, Lucas refers in both works to sexism, by appealing to the idea of 'woman as an object'. In *Au Naturel*, the food materials allude to male and female genitals. In *two fried eggs and kebab*, the food

materials allude to women's breasts and men's genitals (Hazard 2012). In order to let her works function, the importance of using fresh food is obvious, as the image she wanted to evoke would not be the same with degrading food. Firstly, *Two fried eggs and a kebab* by Lucas was created and exhibited in a shop in Soho. In a sense, Sara Lucas treated the replacement of the food as a performance, as every morning she got up and bought a kebab, then fried the eggs and arranged them carefully on a table. At that moment, this 'performance' seemed part of her

installation, but she never thought that anyone would buy it (Freedman 1994). Afterwards, her works were displayed at different exhibitions, such as in 2001 at the S.M.A.K. in Ghent. It then was the job of museum professionals to keep the work fresh with the help of baking instructions of the eggs and the kebab. Furthermore, she emphasized that the food should look fresh and, if degradation would appear, they should be replaced (Quaghebuer 2001).

Nowadays, museum collections grown to encompass art objects beyond physically traditional works; and accepted that change in ephemeral works are inevitable (Barker and Smithen 2006). The status of its acquisition has brought this contemporary art into the museum. Several food-based artworks are collected by museums. To mention a few: MOMA in New York owns works with food by Antoni, Beuys, Spoerri, Roth and Broodthaers; Washington DC's Hirshhorn Museum owns Antoni sculptures; Philadelphia Museum of Art owns works by Duchamp and Leonard; Van Abbemuseum owns Beuys, Broodthaers and Warhol; Tate in London has collected works by Beuys, Roth and Lucas; S.M.A.K. In Ghent (Belgium) owns works by Barney, Spoerri, Beuys, Roth, Broodthaers and De Cupere; M HKA in Antwerp (Belgium) has food works by Heyvaert and Fabre in their collection; MACBA in Barcelona owns Roth, Broodthaers and Matta Clark (see on-line museum collections). More than ever, museum professionals cooperate with artists and define the concepts on an interdisciplinary basis.

But, it cannot be denied that one of the key problems for food-based artworks is the demise or disappearance of the physical artwork or a part of it. The lifespan of food materials is deliberately short and conservators are forced to decide whether to attempt preservation at all, allow degradation (which will result in disappearance) or embrace replication (Mancusi-Ungaro 2009). Collecting units may dispose or de-access artworks, whose condition no longer justifies retention (CIMAM 2011). This could be the case for food-based art, made of materials in which deterioration is inevitable. The guidance issued by professional associations recognizes de-accessioning and disposal, as legitimate tools for collections management. The ICOM code of ethics (2013) and the principles to complete this code concerning de-accession (CIMAM 2011) indicates that the authority to approve de-accession is placed within the institution's governing body. Unfortunately, specific appropriate reasons to de-access are not provided by these codes.

An illustrative case of such a decision is the de-accession process of an edition *Felt Suit* by Joseph Beuys (Barker and Bracker 2005). Whilst this edition had suffered serious degradation, both physically and conceptually, it was decided to remove it from the collection and, Tate placed it in the archive of Tate. This decision was taken following an interdisciplinary approach, in which different stakeholders were taken into account, among them curators, conservators and others art professionals, familiar to Beuys work. Furthermore, the executor of Beuys his Estate, Eva Beuys, controlled the artist's moral rights to claim paternity over the work and, prevents false attribution of authorship. Although, stored as an archived object all parties perceived the work as an important historical document (Barker and Bracker 2005).

In ICOM's definition of museums it is also noted that a museum exhibits the tangible and intangible heritage of humanity for the purpose of education, study and enjoyment (ICOM 2013). This means that documentation of important artworks, such as *Felt Suit* could always be exhibited. Danto (1997) demonstrated that it wasn't until the invention of Pop art that the historical understanding of the means and ends of art was nullified. Danto argued that traditional notions of aesthetics could no longer be applied to contemporary art. Instead, he focused on a philosophy of art criticism that can deal with perhaps the most perplexing feature of contemporary art: that everything is possible. Due to the ephemeral and conceptual nature of contemporary artworks, it is important that the 'tacit' element and the preparatory work of these artworks are thoroughly discussed, documented and preserved along with the physical works themselves (Hummelen and Scholte 2004). As it is impossible to predict what future generations will find interesting, it is indeed worth to document food-based art, even if at a certain moment in time, it could be considered 'dead'. As demonstrated throughout this chapter food-based art was considered uncollectable, than became collected and conserved by art institutions. So, even if food-based artworks disappear in a physical sense, this doesn't mean that documentation could be used for display purposes. Such decisions will depend on what future generations will find valuable. Contemporary conservation theories are based on subjective, relative notions such as meaning and value, rather than on objective notions, such as truth or authenticity. The hardest part of modern and contemporary conservation is not choosing between truth and falsity, but rather choosing who is allowed to enjoy what (Munoz Vinas 2010).





## Chapter 3. Framing food in the context of conservation

### 3.1. Exposing conservation

Diverse strategies of presentation and preservation of contemporary artworks and, the mutual influence between them, were noticed in more recent exhibitions. Exhibitions evolved towards multidisciplinary exhibitions, where curatorial practice involved more than selecting and installing those works of art. More and more, curators and conservators work together, which became clear in the exhibition context. Because of the changeability of ephemeral art, the problems of conservation and presentation became obvious during their exhibition. Sometimes, even the problems of conservation became the subject of exhibitions, in order to stimulate interdisciplinary discussions between artists, curators, conservators, collectors and others.

For instance, *Seeing Double: Emulation in theory and practice* (Guggenheim Museum, March 19 to May 16, 2004) (website *Seeing Double*) was an exhibition that accompanied the conference *Echoes of Art: Emulation as a Preservation Strategy* on the problems of conservation of variable media, organized by the *Variable Media Network (VMN)* (website *VMN*). *Seeing Double* showcased a series of 'original' artworks, with their endangered media installed, side-by-side, with their emulated versions (recreated doubles in newer media), in order to judge whether the emulated works captured the spirit of the originals. Artists, conservators, and media specialists debated the value and role of emulation, as an option for preservation during the conference. Participants compared the strategies and analyzed the *Seeing Double* survey. They searched for signs of consensus from the experts and the lay public on the success of emulation. More and more, exposing conservation and presentation practices became common practice. After the *Inside Installations* (2004-2007) (website *Inside Installations*), a research project in the conservation and presentation of complex installations, one of the partners, the S.M.A.K., organized in 2010 the exhibition *Inside Installations* (website *S.M.A.K.*). This exhibition showed site-specific installation artworks along with their documentation dossiers. During this exposition, museum professionals were constantly rearranging the installations and adapting them and discussed the various arrangements. Also, during this show, the display possibilities of the installation *Piece in Ghent (P.I.G.)* (1994) by Jason Rhoades, containing French fries was examined (see part 3).

Also, next to general variable art exhibitions, some food-based art exhibitions focused on the conservation and presentation issues. Often,

artists, using food materials, are concerned with the questions on the collecting and conservation activity. Therefore, these themes became clear during expositions with food-based art by several artists, such as Dieter Roth, Rirkrit Tiravanija and Felix Gonzalez Torres. Next to the investigation of the concept of Eat Art during those exhibitions, museum professionals were forced to question the preservation of food-based art.

In 2004, the Museum of Modern Art in New York, the Schaulager Basel and Museum Ludwig in Cologne collaborated to present a retrospective *Roth Time: A Dieter Roth Retrospective*. The exhibition was a project of the Schaulager Basel, which is an organization devoted to scholarship, preservation and exhibitions of contemporary art (Dobke and Walter 2004). This exposition questioned the presentation of the perishable works by Dieter Roth, by amplifying his reputation as an artist for whom decay and degradation were included in the concept of his work. In retrospectives on Dieter Roth, the issues of conservation of his food-based art became clear. Museums holding works by Roth represented his work by employing different preservation strategies (Althöfer 1992, Wharton et al. 1995, Bisschoff 2001, Peacock 2006, Van Damme et al. 2006), which became visible during such exhibitions. For instance, in this retrospective some of the chocolate and sugar artworks were presented in display cases, others were not. In some of the artworks the insects, introduced by the artist himself, were still active, in others, carcasses and detritus of the insects remained. By differing the display modus, the audience became aware of the tension the artist created with his 'uncollectable' and 'unpreservable' artworks. All the works belong to different collections worldwide and it became apparent, throughout this exhibition, that every institution or private collector dealt differently with his work but, that they all attempted to preserve their holdings from this remarkable artist.

Sometimes artists were involved in outlining the exhibition concept and, consequently their thoughts about conservation became visible. The retrospective *Tomorrow is Another Fine Day* (2004-2005, Museum Boijmans Van Beuningen, Rotterdam and ARC Musée d'Art Moderne de la Ville de Paris, Couvent des Cordeliers), on the performative work of Rirkrit Tiravanija, dealt with questions concerning the presentation and preservation of his performance- and food-based art. Tiravanija curated this exhibition in cooperation with the American science fiction author Bruce Sterling and the French artist Philippe Parreno. For this exposition, some of Tiravanija's most important performance-based works were shown on a purely conceptual basis. Tiravanija's performances were

created in architectural spaces in museums and galleries. He engaged the audience by cooking Thai meals intended to be consumed. For the first time ever, in this retrospective, the architectural spaces were reconstructed, as for the artist they functioned as forms of reliquaries. The pieces themselves were evoked through texts, based on various memories of the artist's work, written by the artist and the two other curators. A series of hourly-guided tours, audio guides, actors performing regularly and words broadcasted continuously in the exhibition space and gave the public an experience of the installations and performances he made before. In a sense, this exhibition reanimated the artist's most significant works as a ghost ride. Tiravanija explored the process of art-making and the nature of the site where art is produced and exhibited. By doing so, he posed one of the main questions concerning the conservation activity: where is art contained in? Within the object or within the memory of those who pass through it? All those questions remind the intangible aspects of some food-based artworks.

*Specific Objects without Specific Forms* was a major travelling retrospective of Felix Gonzalez-Torres (1957-1996) that included paintings, sculptures, photographic works and public projects, reflecting the full scope of Gonzalez-Torres' career. This Cuban artist worked in New York from 1979 until his untimely death in 1996. Gonzalez-Torres' racial and gender awareness resulted in a production of artworks with an intensely subtle and poignant approach to AIDS activism. Felix Gonzalez-Torres made text pieces, light strings, photographs, stacks of paper and candies often as a metaphor of human fragility at the time of his lover Ross Laycock his decline towards an AIDS-related death in 1991. Viewers were invited to remove sheets or candies, hence making the stacks disappear. His refusal to make a static form, in favour of continuously changing and slowly disappearing form, was an attempt to rehearse his fears of having Ross his disappearing day by day. In a sense, the stacks were a kind of reprise of minimal art, as well as, a highly formal art reinvested with several other meanings (Taylor 2005). Especially, his candy pieces intensify the viewer his relation to the artwork, as it was his intention that the viewer consumes the candies. Thus, the viewer consumes the artwork. In order to re-install his works, reproduction of the candies is needed. The actual artwork, which is acquired by an institution, is not a physical object, but a concept and, hence, documentation becomes the primary objective of the contemporary conservator (see below for the discussion on the conservation of his work). The retrospective *Specific Objects without Specific Forms* defied the idea, that an exhibition is fixed and, that a retrospective is totalizing. At each venue, in which the show

was hosted, the exhibition was open to the public and then halfway through its duration, it was taken down and reinstalled by a different invited artist, whose practice has been informed by Gonzalez-Torres his work. Elena Filipovic curated a first version of the show. The second versions were curated by Danh Vo (both at WIELS, Brussels), Carol Bove (at the Fondation Beyeler, Basel) and Tino Sehgal (at the Museum für Moderne Kunst, Frankfurt am Main). By adding and removing artworks, changing things such as lighting, labels, and the order of presentation, they effectively made an entirely new version of the exhibition. This kind of practice accorded with Gonzalez-Torres his understanding of the artwork as potentially infinite in meaning. Once, Gonzalez-Torres shifted the form and content of an exhibition, going from one venue to another (*Traveling*, 1994) and, in the case of another exhibition (*Every Week There Is Something Different*, 1991), he changed the arrangement of the artworks weekly. Indeed, the resulting retrospective, organized in collaboration with the Felix Gonzalez-Torres Foundation in New York, underscores the enduring legacy of Felix Gonzalez-Torres' oeuvre (Griffin 2010).

Retrospectives, such as those mentioned above, defied, not only the idea of the exhibition as fixed and as totalizing but, also, defied the idea of an artwork with one significance and, with one way of presenting and conserving it. New terminology and practices had to be formulated, because they were occasioned by the need to engage in the issues related to conservation of ephemeral artworks.

### 3.2. Conservation research and practices on food-based art

As mentioned in previous chapters, since the 1980s, museums started to acquire food-based art as a historical and contemporary phenomenon. From the moment food-based art was integrated into the institutional context, museums struggled with how to present and preserve those works. Since the 1990s several important cultural heritage institutions and museums initiated innovative research projects in order to respond to a growing need for alternatives to the traditional scientific conservation approach (chapter 1). They organized conferences to discuss and compare strategies, to cope with the conservation problems for ephemeral and process-based art. Over the years, unstable works with ephemeral materials, such as food, accumulated monetary, social or historical value. Sometimes, this led to conservation interventions. Although, those interventions ethically challenged the conservation practice, they could be considered justified at that time (Wharton 2005).



Fig. 19 Joseph Beuys: *Fettecke in Kartonschachtel*, 1963, Stedelijk Museum, Amsterdam.

One of the first conferences that addressed issues on the conservation of food-based artworks was *From Marble to Chocolate: The Conservation of Modern Sculpture* (Heuman 1995) in 1995, organized by the Tate Gallery in London. This conference paid specific attention to the creative use of transformation, transience and immateriality as concepts throughout new media and new materials, employed by contemporary artists. The issues of conservation and presentation of a few food-based artworks were discussed, through fluxfood objects by Maciunas, sculptures by Mario Merz, Joseph Beuys, Helen Chadwick, Dieter Roth, Anselm Kiefer, Janine Antoni and Claes Oldenburg. Kees Herman Aben described the conservation and treatments on *Dal Miele Alle Ceneri* (*From Honey to Ash* (1984) by Mario Merz (1925-2003) and *Fettecke in Kartonschachtel* (1963) (Figure 19) by Joseph Beuys. Both sculptures belong to the Amsterdam's Stedelijk Museum. *Dal Miele Alle Ceneri*, an igloo made with beeswax panels, had undergone discolouration. Due to oxidation, the panels became brittle and some broke. In 1984, in consultation with Merz, it was decided to mend the breaks, by fusing them together with a hot spatula and wax, in such a way that the repairs were clearly visible. Furthermore, the museum decided to protect the work by moving it to their storage area and, they decided to show the igloo only on very special occasions. This decision was in accordance with the ICOM code of ethics for museums (website ICOM). According to this ethical code, conservation procedures should be as reversible as possible and, all alterations should be clearly distinguishable from the original object. Furthermore, Aben described the conservation decision concerning *Fettecke in Kartonschachtel* by Beuys, which included a corrugated cardboard box with a piece of grey felt, covered in a layer of ivory- coloured, opaque fat. This artwork was protected against deterioration by a Plexiglas display case. However, in 1977, the museum authorized the 'reconstitution' of the work, since the fat had melted, after it was exhibited under a spotlight. Without consulting the artist, the fat was replaced by a less perishable concoction, resembling it closely (Aben 1995). This example demonstrates that conservators at that time struggled for an appropriate approach, in order to deal with the preservation of perishable materials. Since Beuys incorporated the

process of degeneration into much of his work, he might have accepted the melted fat as part of the sculpture's biography (Barker and Bracker 2005). Conservation decisions like this led the conservation community question, whether conventional conservation ethics could be applied to these kinds of ephemeral art forms or, whether they needed a different approach and, whether they needed to revise the ethical code (Wharton et al. 1995).

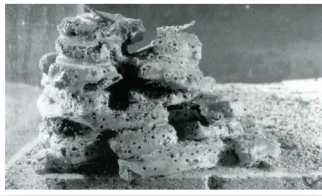


Fig. 20 Claes Oldenburg: *Earthquake*, 1969, collection of Maurice Tuchman

The importance of the artist intent was emphasized during this conference *From Marble to Chocolate: The Conservation of Modern Sculpture*. Wharton, Blank and Dean (1995) underlined the research towards the artist's intention, when outlining conservation strategies throughout food-based works by Claes Oldenburg, Dieter Roth, Anselm Kiefer and Janine

Antoni. *Earthquake* (1969, collection of Maurice Tuchman) (Figure 20) by Oldenburg consisted of a pile of chocolate bars with enamel paint and polyurethane resin poured over them. The sculpture suffered two infestations, one with cigarette beetles and, a second one with carpet beetles. In 1981, the owner and conservator decided to eradicate the insects by controlled freezing. On a second occasion, conservators fumigated the sculpture with methyl bromide. Furthermore, treatments on *Insel* (1968) by Dieter Roth, containing chocolate and yoghurt, and *Poppies and Memories* (1989) by Anselm Kiefer (1945), incorporating poppy seeds were discussed. Both arrived at the National Gallery of Art in Washington with pests. The Roth work was fumigated, but insect carcasses and other detritus were preserved in situ. The poppy seeds in the Kiefer work were removed, frozen and replaced (Wharton et al 1995). Such treatments were rarely described at that time, as conservators were not used to cope with the problems of food-based art and, conservation activities were kept 'behind the scenes'. Those authors dare to question the conservation practices. They questioned the treatments in relation to the artist's intention. Throughout the discussions, it became clear that conservators became aware of the contradiction of the preservation of food materials and the 'original' intention of the artists. Step by step, the problems for conservation were tackled and museum professionals started to cooperate on a more interdisciplinary manner in order to preserve ephemeral art.

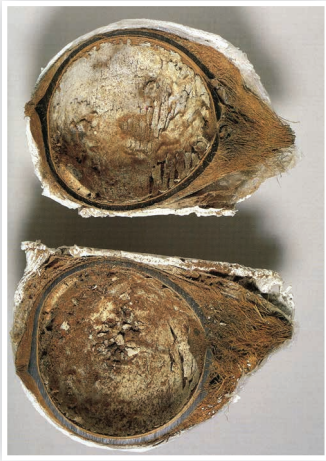


Fig. 21 Antony Gormley: Detail of the cleaned coconut, *Natural Selection*, 1981, Tate Gallery London

In 1999, Tate organized a second conference *Material Matters: The Conservation of Modern Sculpture* (Heuman 1999), in which conservation treatments on a number of artworks with unconventional materials, such as food, were discussed. Treatments on food-based art works by Antony Gormley and Matthew Barney, from their own collection, were discussed, in the light of their technical interest as well as, in the light of their historical importance. Deighton and Heuman (1999) discussed the work *Natural Selection* (1981) by Antony Gormley (1950), containing different food materials (pea, carrot, banana, courgette, cucumber, goose egg, lemon, pear, coconut and melon)

covered with lead shells. In 1983, the goose egg spread an unpleasant smell because of decomposition. In accordance with the artist, conservators opened the lead case in order to oversee the problem and to search for a treatment. The content of the eggshell was removed and soaked for one hour in an alkaline solution, to dissolve and soften the organic matter. The shell fragments were rinsed, until the wash water had a neutral pH (7). pH is the acidity value (being the  $-\log$  (proton concentration) expressed on a scale from 0 to 14 (Jay et al 2005). The shell fragments were then dried, reassembled and glued into position. Afterwards, the goose egg was replaced in the 'original' casing, according to the artist's wishes. In 1996, the lead, encasing the coconut, was seriously corroding, because of the decomposition of the flesh and milk, yielding organic acids. Similarly, the coconut was removed, flesh and milk were removed and, the coconut shell was cleaned, before replacing it in its casing (Figure 21). Afterwards, conservators concluded that it was necessary to store the work in sealed aluminium foil bags with conditioned silica gel to keep them dry (Heuman 1999).





Fig. 22 Matthew Barney: Detail showing yellowed adhesive, *Ottoshaft*, 1992, Tate Gallery, London

During *Material Matters: The Conservation of Modern Sculpture*, Heuman (1999) described the reconstruction of a part of Matthew Barney's (1967) installation *Ottoshaft* (1992, Tate Collection) (Figure 22). This work contained organic and synthetic materials, such as tapioca, bread, meringue, vaseline, silicone, rubber, vinyl, clothes and three videos. The central part of the installation was a huge mattress, made of congealed tapioca mixed with an epoxy resin and, casted to a 100 mm thick oval-shaped foam-wrestling mat. The work was originally exhibited during the exhibition Documenta 9 in 1992 under the curving exit and entry ramps of an underground car park in Kassel (Germany). Barney's material began to absorb moisture from the air and started to swell. After the Documenta show, Tate purchased the piece. The in-house conservators began testing a variety of new tapioca and resin formulae and discovered a more stable mix. Barney adapted the work for display in the 'Art Now' room at the Tate, by using the new mixture for the tapioca mattress recommended by Tate conservators. During this conference, the interpretation of artist's intentions was again highlighted and was even considered as an essential guide to the conservation approach. Furthermore, participants underlined the importance of technology and material science, in order to provide a clearer understanding of the effects and causes of deterioration, which could help conservators to find solutions (Heuman 1999).

In the same year, the Getty Conservation Institute in Los Angeles organized the conference '*Mortality Immortality: The Legacy of 20th-century art*' (Corzo 1999), which brought together professionals, with different philosophies and from many disciplines, to discuss and debate the preservation issues of contemporary art, in which also food-based art was considered. The focus of this meeting was on the issues for the curatorial and art historical disciplines, due to the vulnerability



of materials, the intention of artists and the problems of acquisition of conceptual, non-permanent and ephemeral art. Temkin (1999) described the decision-making processes of conservation in relation to the functionality of food-based artworks by Zoe Leonard (1961) and Felix Gonzalez Torres (1957-1996), during exposition. The role of the museum in maintaining the functionality of the candy pieces by Gonzalez Torres, in which the candies have to be consumed, was discussed. Also, the maintenance of the functionality of the intended perishable work *Strange Fruit (for David)* by Zoe Leonard, in which fruit peels have to decay, was debated. Especially interesting was that it was demonstrated that, as well scientific research, as researching the intention of the artwork, by analyzing the artwork's biography (which also includes the artist intention), could provide a clearer view on decision-making in the conservation of changeable artworks. The discussion focussed on the decision-making process of Leonard her artwork in which the artist could be consulted (See description of possible treatments and decision-making in conservation in chapter 6). Also, the open-ended questions concerning the piece of Torres, who died in 1996, were addressed. In the case of the works by Gonzalez-Torres reproduction is needed, as the candies have to be consumed by the viewer, in order to function. The responsibility of the museum in installing his works is to figure out how the function could be maintained, because the accompanying certificates are in a sense open-ended (Buskirk 2003: 154). The certificates mention explicitly, that the meaning is never secured in any one way and, that the owner has the responsibility to reinterpret the work, when it has to be recreated. Especially, when the artist died, the museum-staff was confronted with a lot of questions concerning the reinstallation of his pieces (Spector 2003).

Works by Gonzalez-Torres were also studied during *The Variable Media Network (VMN)* project (website VMN) (see chapter 1) and the exposition *Specific Objects without Specific Forms* (see chapter 2). Both were organized in order to provide a standard framework for artists and museum professionals, so that they could figure out what really matters to the artist for any particular work of art. Especially interesting was that during the VMN project participants worked, since 2001, on a flexible approach to the preservation of a range of creative practices for changeable art. The works were assigned to categories of installation, instead of media-specific categories, called behaviours, such as interactive, networked, contained, installed, performed and reproduced. They developed preservation strategies, named strategies of 'slippage', such as storage, emulation, migration, and reinterpretation. The variable media paradigm allowed creators to choose out of those strategies,



Fig. 23 Felix Gonzalez-Torres: *Untitled (Throat)*, 1991, Salomon R. Guggenheim, New York.

to tackle the obsolescence of a particular medium. The conservation issues of the candy-work *Untitled (Public Opinion)* (1991) by Gonzalez-Torres were compared with another of his candy staples *Untitled (Throat)* (1991) (Figure 23), both belonging to the Solomon R. Guggenheim in New York (Spector 2003). The research focused on how the works were installed in different exhibition contexts in order to

establish guidelines for resolving the issues in the future. They explored possible preservation strategies, towards the candies themselves, towards the amount of candies and, towards simultaneous exhibitions. In both study-cases the biography of the artworks guided their conservation decision. *Untitled (Throat)* (1991) consisted of one of Gonzalez-Torres his fathers' handkerchiefs, on which cough drops (Luden Honey Lemon, yellow and blue cellophane wrapper) were displayed. Although, this is one of the only pieces from which the public cannot take the candies, it was replenished when the work was presented elsewhere. Luden's Honey Lemon changed at that time from the original cellophane wrapper to a clear one with yellow lettering. As Gonzalez-Torres his father died of throat cancer, and these candies were helpful to him to feel better, choosing the up-to-date standard Luden candies seemed to connect to the relevance of this work instead of choosing for the physical look of the piece. In *Untitled (Public Opinion)* (1991, 700 pounds of cellophane-wrapped black-rod liquorice candy) the candies were meant to be consumed. After the first installation, in 1995, conservator stored a part of the candies, because they ordered too much. As in Gonzalez-Torres his artworks, museum professionals never know how many candies viewers will take, they order some 2000 pounds of candies. In this case, they realized they were running out of candies, so they ordered another 2000 pounds. Here, the candies were part of a Halloween party mix and the company, fabricating those candies, required a minimum order of 2000 pounds (Spector 2003).

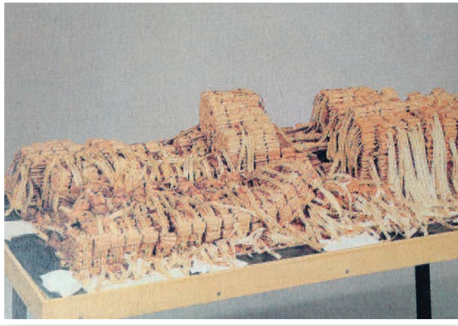


Fig. 24 Dieter Roth: *Schokoladenmeer*, 1970, MACBA, Barcelona.

In 2006, the Chair Karel Geirlandt (associated with Ghent university) organized the conference 'ART & FOOD. FOOD FOR THOUGHT. Contemporary Art on the Menu' (Van Damme et al. 2006), which reflected on the place food and mealtimes occupy in the context of the current art movement. All

kinds of food-based art and the different kinds of media, such as installations, performances, theatre and film that artists use, in order to produce these works, were explored. Also, special attention was given to the conservation and management issues of food-based art. The conservation problems of Eat Art, relying on processes, were discussed in a debate. The discussion focused on a potential irreconcilability between artistic concepts and general principles of conservation ethics, throughout different food-based artworks by Joseph Beuys, Matthew Barney, Rirkrit Tiravanija and Dieter Roth. The description of the treatment on *Schokoladenmeer* (*Chocolate Sea*, 1970) (Figure 24) by Dieter Roth, belonging to the Museum of Contemporary Art in Barcelona (MACBA), was one of the most illustrious in the conservators his struggle with Roth his use of perishability (see also descriptions of different manners of installation of his works in previous chapter). This artwork, containing Lindt chocolate and typed paper, showed extreme effects of decay. Conservators hoped to delay the decaying process of time upon the chocolate, by treating this work in order to eliminate the insect activity. They attracted the male insects towards traps with the introduction of pheromones. Furthermore, the work was protected by a display case and measures to control temperature, humidity and lighting were taken. Conservators at MACBA hoped to slow surface whitening, cracking and powdering of the chocolate and eliminate its unpleasant smell and insect infestation. During the debate on conservation of food-based art, curators, conservators and scientists formulated constructive proposals on the conservation of food-based works, causing their own demise. Again, the importance of the incorporation of knowledge on food preservation and on food science was underlined (transcription of the debate, Van Damme et al. 2006, Groenenboom 2000). Over the years, it became clear that, by using an interdisciplinary approach, conservators became more capable to cope with the issues of food-based art.

### 3.3. Categorizing food-based art

Artists, working with food materials, chose among a range of possibilities in order to produce their works, which can be associated with different movements. Food-based artworks were, and still are, not completed along the same lines. Gradually, artists investigated more ways to achieve their works, which can extend far beyond the traditional physical object and frame of the museum institution (Buskirk 2003). Contemporary artworks no longer consisted of single, enduring objects alone; they became ephemeral, conceptual, divisible and repeatable. As seen before, the introduction of food products in artworks did not know a straightforward historical development. Rather than being one history, there seemed to be several parallel ones, each enacting a particular repertoire of concerns. This multiple history is manifested today in the sheer diversity of works, being produced with those food materials, in which different influences are apparent. By discussing the exhibition practices and the evolution in collecting food-based art, it became clear that the past years different conservation practices were set in: documentation forms, reproductions, replacements and preservation treatments.

A lot of the first food-based productions were preserved in a purely informational form, by collecting and holding archival material, in order to preserve the ideas and concepts of art that no longer existed, because of their ephemeral character. Sometimes even those 'lost' works were recreated, based on the available documentation, in the form of pictures, drawings, instructions, reviews, etc. The preservation issues became really clear when museums started to exhibit and collect the food-based artworks. In order to preserve these works they started to search for methodologies, which seek to define acceptable levels of change within any sculpture, installation, or conceptual work without losing that work's essential meaning. In order to capture the meaning of those works, it appeared important to tackle the requested behaviour of the food, so that the work can function. It could be deduced that for some artists the 'original' food material was important, was it through visualizing degradation or because the artist's touch was evidenced by the choice of specific food materials and/or the production method (which could for instance include a signature). For other artists, the reproduction of their artworks is necessary in order to function.

Dieter Roth's was probably the most famous artist, using degradation of the food as principle feature. He even accelerated degradation processes, by introducing insects in his works, in order to create a continuing

transformation. Mutability and transience were definitely inherent in most of his artworks, connected with the changing form, the play of colours and the variations of putrefaction and moulding. By analyzing Roth's work, museum professionals agreed that all those processes are necessary in order to let most of his work function (Wharton et al. 1995, Green 1998, Mayer 2002 and 2004, Glozer 2002, Dobke 2002 and 2006, Oeri 2004, Vischer 2004, Walter et al 2004, Skowranek 2007). However, not all of Roth's works were intentionally transient. The anecdote mentioned by the Dutch art collector Harry Ruhé in the book *Prima Materia* is illustrative in this respect (Ruhé 1996):

*Once I bought a book onto which Dieter Roth had glued two red-painted sandwiches. The package was sent to me from Germany, but at customs the bag was checked, a common practice at the time. The sandwiches had to be 'opened' as well. When the package finally arrived in Amsterdam, I found, except for a stripped-bare book, just a few breadcrumbs. When I asked the artist about this, he informed me that all I had to do was to buy two new sandwiches, paint them red and glue them to the book!*

This particular case appeared to be an exception to the rules of Dieter Roth, but it demonstrated that each case from a particular artist has to be evaluated in their specific context. Also, the installation of his sugar and chocolate towers in his own *Mould Museum*, and the installation of the same towers in a 'real' museum in Basel (see previous chapter), proved the difficulty of making decisions in the case of intended perishable work. Definitely, it is not easy to let food mould in the right way.

Furthermore, in a whole series of works by Beuys, the food appeals towards degradation. As demonstrated with his work *Fettecke in Kartonschachtel* (see previous chapter), the conservation decision, in which the food was replaced by a less perishable material, followed the principle of the external appearance primacy, which gave rise to vivid discussions (Feilden and Scichilone 1982, Van Mensch 1992, Munoz Vinas 2009, see further also part 3).

Some artists themselves decided to treat their food materials against degradation, such as Robert Gober and Matthew Barney, whether or not in cooperation with conservators or scientists, by extending the life of the food, by mixing them with more stable materials. In these works, the artist's touch was evidenced by the way they produced their works. The preservation of the food, by using additives, by treating the surface or, by storing them in a freezing device was necessary, in order to let the

works function. In order to create 'permanent' food-based works, artists more than often consult conservators or scientists. For instance, Robert Gober shipped his donuts off to Germany to receive extensive treatment from Christian Scheidemann. Scheidemann modified the mechanical properties and the material composition of the food, because for Gober degradation of his donuts was not part of his intention. His sculpture presents itself as a simple replica of its subject. In Gober's work, there is a continual tension between, what an object appears to be and, what it actually is. In Matthew Barney's installation, *Ottoshaft*, the artist neither chose food materials, because of their ephemeral nature. On the contrary, he often mixed his food materials with durable materials. Barney has even more interest in durability than many other 20th century artists who use ephemeral materials, and extracted from each of his materials a theme that he contributed to his narrative.

Treating food-based art against degradation was also done after conservation issues appeared, such as was the case for the works on *Dal Miele Alle Ceneri* by Mario Merz and *Natural Selection* by Antony Gormley. In both cases, the problems appeared when the works were in collections. Conservators consulted those artists and, both worked together, in order to determine which treatment would be justified in order to let the work function.

But, even for artists such as Man Ray, Dali, Warhol, Manzoni, Oldenburg, Kiefer and Spoerri, who did not specify degradation as being part of their works to let them function, replacing the 'original' materials was considered inappropriate. Some of those artists signed their food materials or containments. In some artworks the creation process is visible and some have obtained a 'patina', which remained important. As seen before, their works were preserved by documenting them, by storing them in acclimatized rooms or, by treating the 'original' materials, because replacing the food was not part of the artist's intention. For those works retaining basic characteristics of the materials was more important than the preservation of appearance. Conservators definitely had difficulties to alter the nature of these food materials for the sake of conservation. Even after adaptation of the ethical code (see before), conservators were and still are struggling with these kinds of works. In all those cases, the food can be interpreted as being relics of the artwork whether or not, purely as an important document that has to be stored or, as an 'image' that can be displayed. The external appearance of reconstructions could be very close to the original object, but in view of some artists their philosophy, conservators could wonder whether the

physical object still reflects its conceptual identity. Clearly, the material and technical aspects of a physical object not only mediated the meaning of this artwork, but its non-tangible aspects evoked meaning as well.

Non-tangible aspects evoking meaning could be traced in the discussed artworks: *Pleasure our flower* by Sisley Xhafa, *Au Naturel* and *Two fried eggs and a kebab* by Sarah Lucas, the chocolate sculptures by Sonja Alhauser, the candy staples by Felix Gonzalez Torres, *Mobile kitchen* by Baensch & Dupuis and in Rirkrit Tiravanija's performances during openings. Those artists were not necessarily concerned with retaining the 'original' food in their works. Reproducibility of the artwork or of some parts of the work was programmed from the very beginning. In these cases, the food had to be replaced on a regular basis, because they had to 'look' fresh or because of their consumption. Fresh food was required in those cases, in order to let the works function. Hence, documentation became the primary objective of the contemporary conservator. Here, the difficulty for museum professionals was to capture, how often and, by which means this food needed to be replaced, when defining a conservation strategy. Some artists, such as Sarah Lucas, Sonja Alhauser or Felix Gonzalez Torres gave instructions on how to reproduce their works. But, as demonstrated by Gonzalez-Torres his work, even then, it was difficult to interpret the artist his intention. His definition of what actually constitutes the work was open to questions, such as: 'What is this thing?' and 'Is the work the certificate of authenticity or the piece itself?' (Buskirk 2003). In the case of Alhauser and Tiravanija, the artworks, in which the food has to be consumed, were especially created for a specific exhibition or reproduced by them for following exhibitions. When they were not involved in the production of the food, they decided to show their works by different means, in the form of installations with leftovers, on a pure conceptual basis (such as Tiravanija did in his retrospective) or, by documentation (such as Alhauser). These examples show that more than often, artists were adapting their rules depending on the context in which the artworks were displayed. For instance, at one point Gonzalez-Torres accepted that people did not take parts of his works at the opening of an exhibition, because the museum was afraid the works would be eliminated before the exhibition really began. In another case, he accepted the replenishment of one of his candy pieces with smaller ones, completely different in flavour, because he liked them better than those he originally chose (Spector 2003). By leaving some answers open, the definition of what actually constituted the artwork was blurred. Apparently, there is not one rule to conserve those kinds of works. Again, it appeared that the context of each particular case should be analyzed in order to determine which behaviour of the food product is requested to let the work function.

Food-based art	Food material	Documentation	Preservation	Reconstruction
Bread-related artworks by Dali	<b>Bread</b>	Many writings by the artist in which he explains the idea of his use of bread, photographs		In some of his bread-related artworks the bread loaves were interchanged (buste?)
Artworks with eggs and mussels by Broodthaers	<b>Eggshells, musselshells</b>	Photographs, condition reports, writings, interviews are used to support reconstruction		In some of his eggs paintings the eggshells are interchanged with similar broken eggshells (S.M.A.K.)
Banquets by Marinetti	Different kinds of food	Manifests and writings by the artist	Storage of leftovers, controlled environment	Reconstruction of some performances and installations
Restaurant by Matta Clark	Different kinds of food	Film, photographs, recipes, ads in the magazine <i>Avalanche</i> , listings and descriptions	Storage of leftovers, controlled environment	Reconstruction of some performances and installations
Tableaux-pièges by Spoerri	Different kinds of food	Photographs, condition reports	Storage and display-cases, controlled environment	
Restaurant by Spoerri	Different kinds of food	Many writings by the artist and photographs of the events	Storage of leftovers, controlled environment	Reconstruction of some performances and installations
Food-based artworks by Oldenburg	Different kinds of food: chocolate, jelly, ...	Photographs, writings, plans	Storage, Some sculptures were treated by controlled freezing and fumigation (methyl bromide)	
Culinary actions by Tiravanija	Different kinds of food	<b>Photographs, videos, writings, plans, recipes</b>	Leftovers during display only for the duration of one exposition	Reconstruction of the performance by the artist
<b>performances</b> by Beecroft	Different kinds of food	Film		Reconstruction of the performance by the artist
<b>chocolate</b> machines by Alhauser	<b>Chocolate</b>	Recipes, photographs		Reconstruction by the artist
<b>mobile kitschen</b> by Baensch and Dupuis	Different kinds of food	Drawing, recipes, notes		Reconstruction by the artists
Food-based artworks by Roth	<b>Chocolate, sugar, yoghurt,</b>	Archival documentation, photographs, condition reports, writings, interviews	Storage, stabilizing, environmental preservation (dehydrate machine), treatment by fumigation and other techniques, display cases	Reconstruction by the artist and/or his son
Food-based artworks by Beuys	Fat, chocolate, dry products (spices, flour, canned products, beeswax, ...)	Photographs, condition reports, writings, interviews	Different kind of treatments (fumigation, pheromone traps, environmental preservation, cases during display and storage)	Reconstruction: Replacement by non-food material ( <i>Fettecke</i> )
<b>donuts</b> by Gober	<b>Donuts</b>	Photographs, condition reports, instructions, writings, technical information	Treatment by Scheidemann on demand of the artist	
Food-based artworks by Lucas	Cucumber, grapefruit, baked eggs, kebab	Photographs, condition reports, instructions, writings		Reconstruction: Replacement of the food materials according to the artist wishes
Candy piles by Gonzalez-Torres	<b>Candies</b>	Photographs, condition reports, instructions, writings, technical information	Storage leftovers, controlled environment	Reconstruction: Replacement and/or reproduction by similar candies (emulation or migration)
<b>poppies and memories</b> by Kiefer	<b>Poppy seeds</b>	Photographs, condition reports, instructions, writings, technical information	Treatment by fumigation and freezing	
Natural Selection by Gormley	Coconut, goose egg, pea, carrot, banana, courgette, cucumber, lemon, pear, melon	Photographs, condition reports, instructions, writings, interviews, technical information	Treatment: content of eggshell removed, eggshell soaked in alkaline solution and then rinsed  Storage in aluminium foil bags and silica gel	
<b>iglo's</b> by Merz	<b>Beeswax</b>	Photographs, condition reports, instructions, writings, interviews, technical information	Storage, controlled environment, occasionally display, stabilizing (mending broken parts)	
Ottoshaft by Barney	Tapioca, meringue, bread	Photographs, condition reports, instructions, writings, interviews, technical information	Storage, controlled environment	Recreation: replacement by a new mixture of tapioca
Strange fruit by Leonard	Different kinds of fruit peels	Photographs, condition reports, instructions, writings, interviews, technical information	Storage, controlled environment	

Fig. 25 Documentation and Preservation strategies used for the conservation of food-based art



Categorizing food-based art in the context of conservation appeared to be impossible. A constant dialogue between the artists and the museum, in order to preserve those works of art became more common, because then the requested behaviour of the food could be defined and it became more clear which conservation strategy could be applied. More often, the food materials in food-based art were treated or recreated after their acquirement by the museum, such as parts of the works by Merz and Gormley. Mostly, conservators did their best to maintain the original state of the work as long as possible, but in many cases they had to intervene to avoid the loss of the artwork.

### 3.4. Preservation and documentation of change

In food-based artworks it became clear that the material and content are inextricably intertwined. Previous conservation decisions demonstrated that the material and conceptual authenticity was weighed against each other, in order to conserve food-based art. Definitely, historical knowledge and interpretation and connoisseurship on the process of acquirement informed conservation decisions on the disposition and intention of an artist's work. More than often, museums appeared to emphasize the irreconcilable need to simultaneously maintain both, the material dimension of the work and, its conceptual dimension. Because of the integration of 'change', the concepts of authenticity and the borderlines of conservation and reconstruction of the original substance were revised. Linked to the proliferation of once unusual materials was a constant process of delineation, whereby assumptions that might once have held regarding the givens of a particular medium had been supplanted by an open ended series of considerations, regarding both the initial and the ongoing disposition of the work (Buskirk 2000 and 2003).

Because the materials and formal references of food-based art retained a connection to their original context or use, it is impossible to categorize food-based art in order to outline general conservation guidelines. The notions of performativity and intangibility, such as described by Munoz Vinas (2010), help to understand the works by artists using ephemeral materials and/or media. According to Munoz Vinas, *in modern art an artwork may not be the same as an object, as modern art is often a blend between object-based art and performing arts. Aside from happenings, environments or performances, performativity may adopt different forms in modern art. Artworks expecting to perform chemical, biological or physical changes or other types of mostly irreversible process, may even pose a greater theoretical challenge. Staticism or permanence may than be*

*disregarded as non-relevant or undesirable, as the modification of the work is meant to be part of the work itself. For Munoz Vinas Intangibility is when modern art values the idea more than the resulting material objects. As a consequence, modern art may value the creative process or idea rather than the work itself, which is the materials object with which conservators can work.*

According to Munoz Vinas (2005), the integrity of an object may lie upon four main factors: its material components, its perceivable features, the producer's intent and its original function. Complex issues are presented by contemporary artworks, where much of the meaning lies in the functionality, which also appeared in previous chapters for food-based art. If such functional objects are preserved but not allowed to function, then arguably the intent of the object has been lost. Conversely, if the object is allowed to function, but its functionality destroys it, then museums have lost an object for posterity (Wharton et al 1995). The decision-maker has to assess which feature and which message is more valuable in each case.

As seen in previous chapters, artists, conservators and other professionals conserved food-based art, by different means of documentation and/or, by preserving the physical object by treatment or reconstruction (Figure 25). Because food materials possess an inherent vice (see chapter 1), food-based artworks often resulted in the demise or disappearance of the physical artworks. Therefore documentation appeared very important. As seen before, in the first Eat Art exhibitions various forms of documentation, made by the artists themselves or by other participants, were displayed, such as films, photographs, texts, recipes, notebooks, magazines and leftovers. After that the works were moving inside the centre of museum activities, museum professionals started to document the food-based artworks, whether or not in cooperation with the artists. Furthermore, recreations of 'lost' works were tolerated in order to visualize them for the audience. More and more, documentation, recreation and replacements were seen as a form of conservation. Since dematerialization is inherently connected to food-based, conservators improved the registration of information through documentary records. But, the preservation of a physical artwork can be a way of the artist or, of the conservator to forward the meaning of food-based art towards future generations.

In following chapters, this study took stock of the current interests, needs and intentions in the conservation profession. Conservators often carried out treatments on food-based art, by working with a limited range of appropriate treatment options and, without the desired level of understanding of the materials, decay processes and the long-term consequences of their use. Although, there are some examples of treatments on food-based art, there appeared to be a lack of knowledge on food preservation and food science. In order to respond to the growing need to involve more scientific and technical knowledge in the conservation of perishable art, this PhD research focused on the investigation of the implementation possibilities and limitations of food preservation science into the conservation of food-based art. The intangible aspects of food-based art were captured and the functionality of food was defined. This informs conservators about what exactly to preserve and let them understand which resources and materials are necessary, to maintain the artwork. If food materials have to degrade, reproduced or consumed, knowledge about the degradation processes of food materials and, in particular about their preservation in the food industry, could lead to suitable solutions for art conservators, which will become clear in the following chapters.



## PART 2: PRESERVATION OF FOOD-BASED ART AND FOOD PRESERVATION TECHNIQUES: DEGRADATION PROCESSES AND POTENTIAL SOLUTIONS

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### Chapter 4. Degradation processes, intrinsic and extrinsic parameters of food-based art

#### 4.1. Conservation science of traditional artist materials versus modern and contemporary materials

The manner in which artist materials in general degrade and the life span of artworks, even produced with the same kind of materials, differ with each specific material and production mode. Natural ageing of the materials and the impact of light, temperature, humidity and handling of artworks all take their toll. Art conservators try to retard processes of degradation by different means. For taking the right measures in preservation one of the most important aspects is to gather as much information as possible on the materials. The determination of the causes and mechanisms of deterioration, and the determination of changes in appearance and physical properties due to ageing processes, informs conservators about preservation possibilities (Lahanier et al 1986).

For most traditional art materials, such as stone, wood, bone, ceramics, glass, metals, oil paintings and paper, preservation technologies are available to preserve the artworks over a long period of time. Over the years conservation practitioners developed preservation techniques for traditional art materials. They worked by trial and error and developed methods to address deterioration when it occurred. Conservators figured out environmental conditions that can slow down changes and have come up with solutions in order to stabilize traditional artworks. They were able to observe traditional materials under a range of stressors and experienced how variations in their makeup can affect longevity. Also, the artists benefitted from this knowledge and optimized their use of those traditional art materials. Furthermore, the input of scientific research elaborated outside the art conservation profession provided a clearer understanding of the effects and causes of deterioration and helped art conservators to find solutions to complex problems (Mills and White 1987, Daniels 1998, Pavlogeorgatos 2003, Sterflinger and Pinar 2013).

Traditional art materials	New art materials
e.g. leather, wood, bone, ceramics, glass, metals, paper	e.g. plastics, foods, new media
Preservation technologies and methods were developed	Preservation technologies and methods are in development
Materials that survived are in se durable	Less knowledge on the durability
More experienced research, also outside the art conservation profession	Less experienced research
Scientific research is very important	Scientific research is not always necessary because of some more concept-based artworks. Although in some cases it can be used to support the preservation of the 'real' artwork, which could be seen as a very important document.

Fig. 26 Research in art conservation for traditional and new materials

All this prior knowledge and experience was absent when in the 1960s new artist materials, such as plastics, new media (video art, internet art, etc.) or food, were introduced in artworks (Figure 26). Preservation technologies were not developed in the conservation profession. For new media and plastics, artists and conservators were confronted with a lot of unexpected conservation issues. For these materials they could not rely on years of experience in other related fields. Scientific research in new materials is more recent and is therefore less experienced by the art conservation profession (Bell and Mc Phail 2007, Sterflinger and Pinar 2013).

When artists started to use food in their artworks, art conservators were, although less unexpected, also confronted with a lot of conservation issues. Contrary to new media and plastics, the research in food preservation has been experienced for years in the food industry. Scientific research and material knowledge was and is thus available. Through the transfer of knowledge from the food industry and related food preservation research, conservators can enrich their knowledge on the behaviour of food and the principles of food preservation. Knowledge on food science could offer conservators insight towards suitable preservation techniques

and treatments for food-based artworks. Also, food science knowledge can give conservators insight towards the reproduction of the food, in order to maximize the duration of their preservation. In this chapter food deterioration processes and which aspects influence those processes will be explained.

#### 4.2. Degradation processes of food

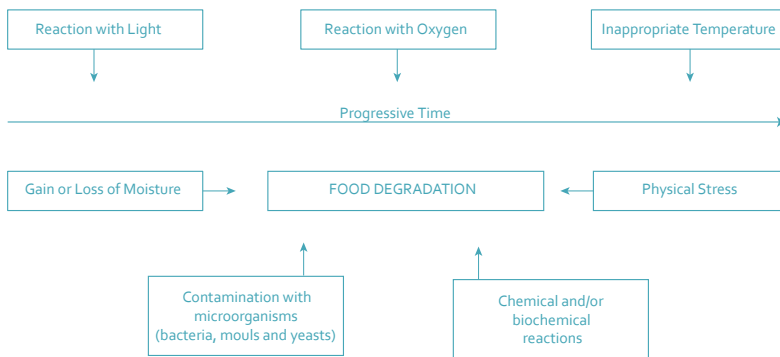


Fig. 27 Causes of food degradation

Food materials remain unstable and are therefore prone to decay. Food undergoes deterioration of varying degrees in their sensory characteristics, nutritional value, safety and aesthetic appeal. Most food materials undergo progressive deterioration, due to microbiological, biological, physiological, physical and chemical processes, or combinations thereof (Figure 27) (Devlieghere et al 2011). Depending on the kind of food, one or several of these degradation processes will predominate.

Biological degradation is caused by the disintegration of biological systems. There are two kinds of biological degradation: microbiological and macro-biological degradation. Microbiological degradation processes are caused by the activity of bacteria, yeasts and moulds. Some microorganisms can be beneficial (e.g. lactic acid bacteria (LAB) providing yoghurt its specific aroma), but others can cause spoilage or even food poisoning (pathogens). Spoiled food is unfit for consumption, because of their deviating taste, odour, colour or texture. The group of pathogens can lead to human illness. Bacteria, yeasts and moulds can grow in food. The growth of microorganisms can be divided into four phases: the lag

phase or adaptation phase (1), the log phase or exponential phase (2), the stationary phase (3) and the decay phase (4) (Figure 28). In order to preserve food longer, the lag phase should be extended (Devlieghere et al. 2011).

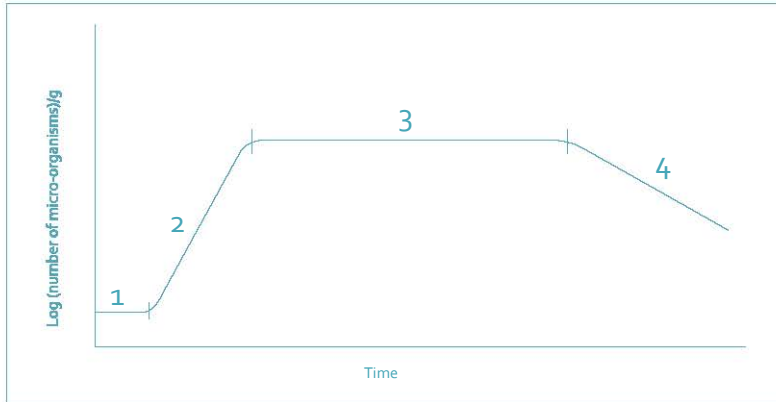


Fig. 28 Bacterial growth curve

Next to microbiological degradation other macro-biological degradation processes exist, which are caused by the activity of e.g. insects, rats and other kinds of pests attracted by the food. Food products are susceptible to pest infestation. Clearly, this kind of infestation should be avoided. This type of damage has a bad influence on several kinds of art materials. Concerning food materials, nearly all fruits, vegetables and dried food products are susceptible to insect infestation.

Physiological degradation processes occur in food products that respire, such as fruits and vegetables. Such 'living' food starts to decompose after they are harvested. Fresh cut products generally have higher respiration rates than the corresponding intact products. This respiration rate indicates a more active metabolism and usually a faster deterioration rate. The physical damage increases respiration and ethylene production, with associated increases in rates of biochemical interactions responsible for changes in colour (including browning), flavour, texture and nutritional quality (sugar, acid, vitamin content) (Kader 2002). The incidence and disorders depend upon the physiological age of the commodity, temperature, ethylene concentration and duration of exposure to ethylene (Pratt and Goeschl 1969). For instance, fresh cut food products are physically damaged or wounded which increases respiration and ethylene production within minutes, resulting in e.g. loss of green colour and leaf abscission of cabbage (Kader 1985).



Physical degradation processes can be caused by mechanical damage. This type of damage is of course not typical for food only. But physical degradation processes in food can also occur when the environmental conditions change. For instance, when fat or ice start melting, then something physically changes in the food. When water changes to ice, the molecules themselves do not change, but the arrangements and distance between the molecules change (Belitz et al. 2009).

Chemical degradation processes are complex processes due to the fact that food consists of typically various major (e.g. water, proteins, lipids and carbohydrates) and minor (e.g. minerals, vitamins, pigments and enzymes) components. Those components can enter into chemical interactions with themselves, mutually or with environmental factors (e.g. oxygen). For food-based art the main chemical processes that have to be taken into account are probably lipid oxidation (reaction of lipids with oxygen) and lipolysis (reaction of lipids with water). These processes will cause rancidity, which will affect the odour, taste and texture of food products (Fennema 1996). Lipid oxidation reactions are exceedingly complex and generalizations to ascertain the mechanistic pathways are not always justified. It is agreed that the reaction with molecular oxygen is the main reaction involved in oxidative deterioration of lipids (Fennema 1996). The lipids can be oxidized by both enzymatic and non-enzymatic mechanisms. Oxidative rancidity can be measured by a peroxide value (POV) determination. Lipolysis is a major reaction occurring during deep fat frying due to the large amounts of water introduced from the food, and the relatively high temperatures at which the oil is maintained. Lipolysis may occur by heat and moisture, but also by enzyme action, resulting in the development of high levels of free fatty acids, which are more susceptible to oxidation than fatty acids and can have a typical smell too (e.g. rancid butter). Lipolysis can be measured by monitoring the free fatty acid concentrations (Fennema 1996).

Parameters	Degradation processes			
	microbiological	physiological	physical	chemical
$a_w$ / RH	x	x	x	x
pH	x	x	-	x
$E_h$	x	x	?	x
T	x	x	x	x
Light	-		x	-

Fig. 29 Types of degradation

Food preservation is based on slow down those degradation processes or, if possible, on stopping those processes. The way this can be obtained will be explained in the next chapter. Next to slowing down or stopping the degradation processes of importance for food-based art, the control of these degradation processes also depends on intrinsic (peculiar to the food itself) and extrinsic (peculiar to the surrounding atmosphere) parameters (Ooraikul 2003) (Figure 29).

#### 4.3. Intrinsic parameters of food

The intrinsic parameters are the physical and chemical characteristics of foodstuffs and are a part of the food product itself. What follows is a list of these parameters that may either result in enhancement or inhibition of the degradation processes.

Composition of a food product: The composition of a food product determines its safety, nutritional and physicochemical properties, quality attributes and sensory characteristics. Most food is compositionally complex materials made up of a wide variety of different chemical constituents. Their composition can be specified in a number of different ways, depending on the property that is of interest to the analyst and to the type of analytical procedure used: specific atoms (e.g., Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur, Sodium, etc.); specific molecules (e.g., water, sucrose, tristearin, b-lactoglobulin), types of molecules (e.g., fats, proteins, carbohydrates, fiber, minerals), or specific substances (e.g., peas, flour, milk, peanuts, butter). The qualitative and quantitative composition is different for each food type. Concerning microbiological degradation, it is important to note that in order to grow and function, microorganisms present in a food product require the following: water, energy sources, nitrogen, vitamins and minerals. Sources of energy are: carbohydrates, organic acids, amino acids and alcohols. Some

microorganisms are even able to use lipids as energy source. The nitrogen-source is needed for the synthesis of microorganisms. The presence of vitamins in food products influences the growth of microorganisms. Minerals, occurring in the form of salts, are indispensable for various cell functions. The kind and level of availability of these nutrients will determine the growth of microorganisms (Devlieghere et al. 2011). It is also obvious that the chemical composition of the food has an influence. It determines the chemistry of the food itself, i.e. it determines which chemical reactions will or can occur.

Food product	$a_w$ value
Milk, fruit and vegetables	0,995-0,998
Raw meat and raw fish	0,990-0,995
Cooked meat and smoked salmon	0,965-0,980
Paté	0,96-0,97
Cheese spread	0,95
Caviar	0,92
Bread	0,90-0,95
Salami (dry)	0,85- 0,90
Chocolate fillings	0,83
Fruit cakes and soy sauce	0,80
Salted fish and honey	0,75
Dried Fruit	0,60-0,75
Cereals, candy and chocolate paste	0,70-0,80
Ice cream at -40°C	0,68
Dried pasta, herbs and milk powder	0,20-0,60
Freeze-dried products	0,10-0,25

Fig. 30 Water activity of different food types (Devlieghere et al. 2011)

$a_w$  (water activity): The  $a_w$  is one of the determining factors of degradation processes of organic materials and expresses the availability of water inside a food matrix. It should be realised that water typically acts as a solvent, in which microbiological nutrients can be transported or chemical components can come into contact with each other and thus react. The scale of  $a_w$  varies between 0 (no free water) and 1 (pure water). It is measured by determining the relative humidity (RH, see extrinsic parameters below) of the headspace of a closed recipient in which a product is stored, or it can be measured by determining the freezing

point of the food. Measuring  $a_w$  is a different way of looking at a sample in relation to its actual moisture content. In general, monitoring moisture in organic materials is important as it influences many of their physical and mechanical properties. Moisture content defines the amount of water in a material and water activity defines how that water will react with other substances and affect them (Pixton 1966).

Food with  $a_w$  values between 0,65 and 0,99 can be subjected to microbiological, chemical and biochemical spoilage, while food with  $a_w$  smaller than 0,65 will be only subjected to chemical and biochemical spoilage. Each food product has a different water activity (Figure 30). The unbound moisture in food supports microbiological growth.  $A_w$  has its most useful application in predicting the growth of bacteria, yeasts and moulds (Devlieghere et al 2011).

Chemical degradation, such as oxidation processes, are strongly dependent on the  $a_w$  value of a food product. In dried food with  $a_w$  values less than about 0,1, oxidation processes proceeds very rapidly. Increasing the  $a_w$  to values about 0,3, retards lipid oxidation. The protective effect of water is believed to occur by reducing the catalytic activity of metal catalysts, by quenching free radicals, and/ or by preventing the access of oxygen to the food. Lipid oxidation is lowest around  $a_w = 0,4$  and increases again at higher levels (Karel 1980, Fennema 1996).

Physical degradation will also be influenced by the water activity. For instance, crisp breads, wafers and crackers are hygroscopic due to their chemical composition, porosity and presence of starch in the amorphous state (Colonna et al. 1984, Marzec & Lewicki 2006). If the moisture of these crispy products increases, due to water sorption from the atmosphere, it results in a soggy and soft texture (Nicholls et al. 1995).

Physiological and biochemical changes in food are  $a_w$  dependent. For instance, when considering dried fruits, the evaporation of water results in a concentration of fruit constituents. Reducing the moisture content through dehydration processes inhibits enzymatic browning reactions. Enzymatic activity in food products is inhibited at  $a_w < 0.65$  (Bonazzi & Dumoulin 2011). Although some enzymatic reactions will still occur at lower  $a_w$ . Food with high  $a_w$  has a texture that is described as moist, juicy, tender, and chewy. When the  $a_w$  of these products is lowered, textural attributes (such as hardness, dryness, staleness, and toughness) are observed. For instance, dried fruits involve modification of the physical structure. Dried products are characterized by low porosity and high apparent density. Significant colour changes occur during air-drying. Most frequently, the dried product has low sorption capacity (Bonazzi & Dumoulin 2011).

Food product	pH value
Meat *	5,6-6,5
Fish *	5,2-6,8
Shellfish *	6,3-7,0
Molluscs *	5,9-6,7
Poultry *	6,2-6,7
Eggs	6,8 (yolk)-9,3 (white)
Milk	6,5-7,0
Vegetables	4,2 (tomato)-6,5 (beans)
Fruit	1,8 (lemon)-6,7 (melon)
Cereals	6,5-7,0

\* The pH of this group of food products depend on the "rigor mortis" period. During this period the glycogen, that is present in the muscle, is converted into lactic acid. This process is called glycolysis. The more glycogen the muscle contains at the moment of death, the more lactic acid can be build up, and the lower the pH will be. This can be achieved by slaughtering or killing animals, which have done little or no work and did not suffer from stress prior to their death. The conversion of glycogen into lactic acid takes place in meat, shellfish and poultry. In molluscs o the other hand, a weak activity of lactate dehydrogenase in the muscle causes the conversion of lactic acid into pyruvic acid and succenic acid (Krebs cycle).

Fig. 31 Summary of food types and their pH values (Devlieghere et al. 2011)

pH (acidity value, being  $-\log H^+$  proton concentration):

pH is a measure of the acidity of an aqueous solution. This value is expressed on a scale from 0 to 14. Microbiological degradation is influenced by pH. Microorganisms are only able to grow within a specific pH range. Their growth is characterized by a minimal, optimal and maximal pH value. pH is one of the factors determining which nutrients will be in water and to which extent. Optimal pH values for preservation are different for each raw food type (Figure 31) (Devlieghere et al 2011). The minimum, optimum and maximum pH values for the growth of microorganisms are different for bacteria, moulds and yeasts (Figure 32). However there are exceptions in the group of bacteria. For instance, lactic acid bacteria (min. pH = 3,3 and max. pH = 7,2) are often found in acid food.

Micro-organism	pH value		
	minimum	optimum	maximum
Bacteria	4.4	7.0	9.8
Yeasts	1.5	4.0-6.0	9.0
Moulds	1.5	7.0	11.0

Fig. 32 pH minimum, optimum and maximum values for the growth of microorganisms (Devlieghere et al. 2011)

Physiological degradation processes and the relation with the pH value are limited. For instance, wounding of fruit tissues induces a number of physiological disorders that need to be minimised to get fresh-like quality products. In fresh-cut fruits, the greatest hurdle is the limited shelf life, which is due to excessive tissue softening and cut surface browning. Surface treatments help to delay physiological decay in fruit tissues, thus stabilising the fruit surface and preventing degradation processes that curb the quality of the product. The effects of these treatments on the fruit surface are also subject to the solution pH (Soliva-Fortuni 2003). For instance, ascorbic acid (e.g. lemon juice), which has a low pH, helps prevent browning of an apple (Pissocaro et al. 1993). Physical degradation processes and the influence by pH are limited to such an extent that they will not be of interest for this PhD study.

Concerning chemical degradation, the pH of a muscle is recognised as an important factor influencing the rate and extent of lipid oxidation in different kinds of animal muscle tissues. It was found that there was considerably more oxidation at low pH values (e.g. pH 3) compared to higher pH values due to a higher pro-oxidant effect of the meat pigments (e.g. metmyoglobin) (Tichivangana and Morrissey 1985). Similarly various other chemical reactions may be influenced by the pH of the food.

#### Eh (Oxidation-reduction potential):

Eh is determined by the presence or absence of appropriate quantities of oxidizing and reducing compounds. These compounds are important to the growth and activity of all microorganisms. Microorganisms display varying degrees of sensitivity to the oxidation-reduction potential of their growth medium or environment. Aerobic microorganisms require more oxidized environments (more oxygen, thus higher Eh) versus anaerobic organisms, which require more reduced environments (lacking oxygen, thus lower Eh) (Jay et al 2005).

Physiological degradation is also influenced by the Eh. For instance, fruit and vegetables, which are respiring products, have to be preserved in aerobic environments (Devlieghere et al 2011).

For physical degradation phenomena, the redox potential probably has only an indirect effect. For instance, a metal can, suffering corrosion, will after some time show physical degradation as well, but the primary origin is a chemical process.

Various chemical reactions occurring in food and biological matrices involve oxidation or reduction reactions. The most obvious examples are oxidation reactions of for instance lipids, vitamins, pigments and proteins. It is obvious that when the oxidation-reduction potential is negative, that oxidation reactions are reduced or can even be avoided. Thus, for

instance, vacuum-packed meat will have a better colour stability than meat packed in atmospheric conditions.

Antimicrobial constituents: Some food products contain natural antimicrobial substances and are reported to be effective against spoilage and pathogenic microorganisms. For instance, fresh milk contains lactenin and an anticolidiform factor, cranberries contain benzoic acid and spices contain some essential oils with antimicrobial properties. Another important natural antimicrobial substance is lysozyme in egg white (Devlieghere et al 2011). Lactic acid bacteria (LAB) and acetic acid bacteria produce the corresponding organic acids. The pH reduces and some microorganisms are inhibited, because of the anti-microbiological effect of the acids themselves. Some microorganisms, like lactic acid bacteria, are capable of producing antibiotics and/or bacteriocins in the food, which cause a further inhibition of the growth of other microorganisms (Devlieghere et al 2011).

Antioxidant constituents: Some food products can have antioxidant properties, such as some commercial oils (all vegetable oils contain tocopherol or vitamin E, which is strong natural antioxidant). They may be valuable for increasing the shelf life of food products as e.g. protectors of highly unsaturated lipids for oxidation (Barrata et al. 1998). Also lycopene, the pigment principally responsible for the characteristic deep-red colour of ripe tomato fruits and tomato products, has antioxidant effects (Le Maguer 2000).

Biological structures: The natural covering of some food sources provides excellent protection against the entry and subsequent damage by spoilage organisms and thus protects the food. Examples of such protective structure are the hide, skin and feathers of animals (Devlieghere et al 2011).

#### 4.4. Extrinsic parameters of food

Extrinsic parameters are those properties of the environment that exist outside the food. The environment in which food materials are present affects the food materials, influencing microbiological, physical, physiological and chemical processes. For each process specific environmental conditions are required.

Extrinsic parameters are:

Temperature (T): When considering food products used in artworks, generally low storage temperature should be used, if the sensory features of the food allows it. Ideal storage temperatures would then be in between 0-7°C, which is much lower than generally applied in museum storage (18°C). Separate storage for the food should thus be required. A refrigerator (depending on the food type: <4°C or < 10°C) only purposed for storing the food materials would be recommended.

Microorganisms, individually and as group, grow over a wide range of temperatures (from -18°C until 70°C). It is important to know the temperature growth ranges of organisms, because those ranges are an aid in selecting the proper temperature for food storage (Devlieghere et al. 2011). In general however, the lower the storage T, the better for the preservation of food.

Physiological changes also occur when the temperature changes. For instance, salad has to be stored in a cold environment, i.e. in a refrigerator. If stored at room temperature physiological degradation will increase, because of accelerated respiration. For instance, high and fluctuating temperatures cause and accelerate fat bloom. Fat bloom is the accumulation of large cocoa butter crystals on chocolate surfaces. It appears as a thin coating or scattered white patches (Lawler and Dimick 2002). Fat migration can occur at a considerable rate at room temperature (17 °C - 23 °C) and increases as the temperature increases. Furthermore, changing temperature causes the melting and the recrystallisation of low melting crystals. The process has an impact on the microstructure, visual appearance and textural properties (De Pelsmaeker et al. 2013).

In general, for chemical and biochemical reactions, it can be assumed that an increase of a temperature by 10°C results in doubling the reaction kinetics.

Furthermore, high temperatures have an influence on physical changes, e.g. fat start melting when the temperature is raised. Temperature also has its influence on chemical and biochemical reactions (Devlieghere et al. 2011).

Relative humidity (RH): In comparison with other art materials food, with a higher water activity requires a high RH (60-70 %), while in museum storage 55% is mostly maintained. In such cases, separate storage for the food, such as in a refrigerator (60-70% RH), is required. It should be realised that the food will tend to reach a water activity that is equal to the relative humidity of its environment. Thus a piece of fruit, having a high water activity (> 0,95), will suffer from dehydration and shrinking in a typical museum environment.



Light: All materials are sensitive to light (including visible light) especially organic materials. The absorbed quantity of light can induce some chemical reactions, typically linked to oxidation. Therefore the light factor is as much as possible excluded in the museum storage. Also for food products, light has an influence on their degradation. Food products contain a lot of light sensitive components, such as vitamins, pigments, lipids, etc. These light-induced reactions include the destruction of chlorophyll (the photosynthetic pigment that gives plants their green colour), resulting in: the bleaching of certain vegetables, the discoloration of fresh meats, the destruction of riboflavin in milk and, the oxidation of vitamin C and carotenoid pigments (a process called photosensitized oxidation) (Belitz 2009).

Considering the potential impact of light on physical degradation processes, especially the potential thermal impact of exposure to a particular light source should be considered. Sunlight and electric bulbs emit apart from the visible light also infrared radiation, which will typically increase the temperature of the illuminated product. Obviously this may induce melting phenomena in the exposed object. The use of LED illumination will avoid this problem (Fennema 1996).

Presence/concentration of gases (other than water vapour): The presence of gases, such as carbon dioxide (CO<sub>2</sub>), nitrogen (N<sub>2</sub>) and oxygen (O<sub>2</sub>), has an influence on the degradation and/or preservation of art materials. Especially, the presence of O<sub>2</sub> has to be avoided or reduced, because of its influence on various degradation mechanisms (Daniels 1998). It should be noted however that, contradictory sometimes very high O<sub>2</sub> concentrations are also used in food preservation practice. High concentrations of O<sub>2</sub> inhibit the growth of psychrotrophic spoilage organisms and lactic acid bacteria (LAB). Furthermore O<sub>2</sub> concentrations of i.e. 90 % appear to inhibit the outgrowth of moulds (Devlieghere et al 2011). Low O<sub>2</sub> concentrations (1-5%) are needed, such as for fruits and vegetables to reduce the respiration rate, which prolongs their shelf life (Lee et al 1995).

Although N<sub>2</sub> has no antimicrobial effect, it is used as displacement for O<sub>2</sub> and helps to retard the growth of aerobic spoilage organisms (see next chapter). CO<sub>2</sub> is the most important atmospheric gas that is used to control microorganisms in food (Farber 1991). Microorganisms need CO<sub>2</sub> for their own metabolism. The CO<sub>2</sub> they produce themselves usually covers this need and therefore microorganisms seldom have a net need for CO<sub>2</sub>. At a CO<sub>2</sub> concentration > 10% microorganisms are inhibited, depending on the type of organism, storage temperature, a<sub>w</sub> of the food product and depending on the growth phase of the microorganisms

(Devlieghere et al 2011). A number of theories have been suggested to explain the antimicrobial effect of CO<sub>2</sub> (summarized by Farber 1991). It has been accepted that CO<sub>2</sub> has a significant and direct antimicrobial activity. While aerobic bacteria are inhibited to moderate high levels of CO<sub>2</sub> (10-20%), some Lactic acid bacteria however are less susceptible to CO<sub>2</sub> (Farber 1991, Devlieghere et al 2011).

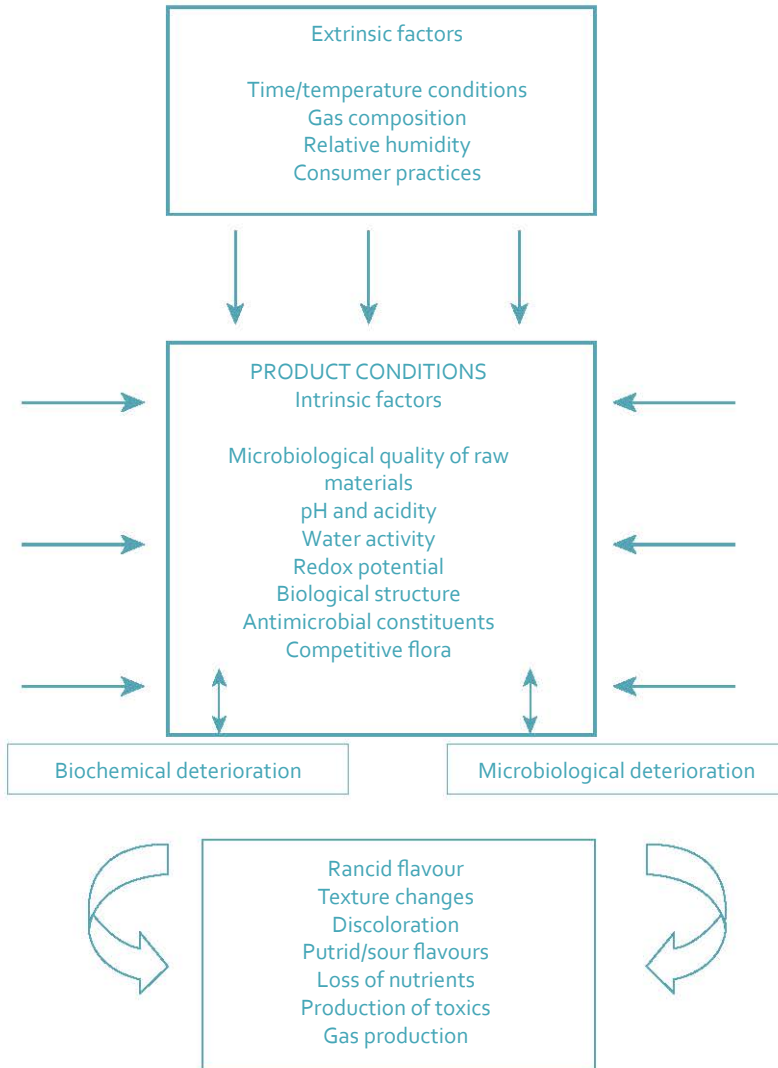


Fig. 33 Food degradation and the influence of intrinsic and extrinsic parameters

#### 4.5. Contextual framework of food degradation in the food industry versus food degradation in food-based art: Interaction of various parallel degradation processes.

As mentioned before, several biological, physiological, physical and chemical degradation processes occur in food. In the context of this PhD research, it is important to notice that these reactions occur parallel, but that the kinetic of the several processes is different. Among the different processes, one is responsible for the unsuitability of the food product, namely the specific cause of unsuitability. Which is understood by 'unsuitable' is subjected to individual perceptions (Valero et al. 2012). Clearly, some food degradation processes allowed in artworks will not be allowed in the food industry.

For instance, when considering the raw cured ham that Jan Fabre used to create *Untitled* (2000) for the exhibition *Over The Edges* in Ghent (introduction), degradation processes, which occurred during the exhibition, were acceptable until a certain moment. Degradation processes, such as the discolouration of the ham and even the mould development in its first stage, would never have been allowed in the food industry.

To determine the sensitivity of raw cured ham, it is necessary to know the sensitivity of this product to all the different degradation processes. As seen in this chapter, such reactions can be very matrix dependent. Dried cured ham available in a supermarket has an  $a_w$  value of  $0.92 \pm 0.015$  and pH of  $5.60 \pm 0.12$  (Cliquart et al. 1998). Therefore, microbiological proliferation (e.g. mould growth), lipid degradation (due to lipolysis of enzymatic origin and to lipid oxidation) and discolouration (due to oxidation processes) can be expected (Devlieghere et al. 2011, Hamilton 1989). In the food industry the shelf life of raw cured ham will be determined by the discolouration and/or by possible mould growth.

In food-based artworks the shelf life can be determined by other degradation mechanisms. The raw cured ham used by Jan Fabre started to discolour, as the temperature during the exposition was too high to preserve the meat. Because of the exposition context (outside from April-June 2000), it was not possible to create temperatures lower than  $18^\circ\text{C}$ . As high-temperature speeds up oxidation reactions, the meat shifted from a red to a brown colour (Bailey 1994). This discolouration was a degradation process that did not determine the shelf life of the artwork. Furthermore, when lipid oxidation increased it led to rancidity and rancid odour (Devlieghere et al 2011). Because of moisture uptake and

microbiological contamination from the environment, the meat slices became microbiologically unstable and then moulding started. When the mould development increased and a rancid odour proliferated, the decision was reached to remove the artwork.

In order to preserve food-based art, identification of all related factors that can potentially influence the food shelf life is crucial (Valero et al. 2012). Based on the information collected, shelf life estimations can be given, depending on the context for preservation of a food-based artwork.

#### 4.6. Preservation requirements for food-based art

To create food-based artworks, artists often combine food products with other organic or inorganic materials. Understanding the composition of each material in an object is one thing, but the interaction of those materials and the way the artist produced the artwork are as much important. Therefore information about the degradation processes and the effect of interactions with other materials and their environment should all be considered in the decision-making process for conservation and should be translated into appropriate display, storage and travelling contexts.

Generally a museum environment, appropriate for the preservation of mixed collections, maintains following environmental conditions: a temperature of 18°C +/- 1 °C and a relative humidity of 50 % +/- 5% (Reilly 2013). Nevertheless, there is no 'ideal' environmental standard that is easily attainable and appropriate for the preservation of mixed collections. Because of the large variations in combinations of materials (e.g. Broodthaers' egg shells glued on a wooden board, Spoerri's leftovers glued on table-tops, Leonard's embroidered fruit peels, etc), it is impossible to create ideal storage and /or display conditions for food-based artworks that are in accordance with all the different components in one artwork. As food products are among the most sensitive materials, special attention is required (Figure 34). Even for food-based art in which the food materials are not treated or manipulated, it was showed in this chapter that every food type has different requirements.

Material	T		RH
	Max. °C	Min. °C	
Paper, aquarel, textile, feather, wax, leather, drawings, ivory, parchment, wood, bones, paintings, rubber, chalk	25	2	52+/-3%
Metals (iron, copper, lead, zinc)	25	2	< 45%
Ceramics, pottery, tiles, enamel, glass	25	2	constant
Minerals, stone	22	16	30-50%
Meat, fish, poultry, fruits, vegetables, milk, fruit and vegetable canned products	4	4	<98%
Cheese, bread, tomato-spread	4	2	93-98%
Dried meat, concentrated and sweetened milk, aged cheese	7	4	85-93%
Dried fruit, flour, cereals, marmalade, nuts	7	4	60-85%
Chocolate, honey, pasta, bisquits, milkpowder, eggpowder	7	4	>60%

Fig. 34 Environmental conditions for traditional art materials and food materials

Furthermore, when comparing the environmental conditions necessary to preserve the more traditional art materials and those necessary to preserve food, one can see that the maximum preservation temperature for food is much lower than for traditional materials. Also, the required relative humidity for food is higher than for traditional materials. Therefore an understanding of the real conservation needs of the different types of food is needed. Food science knowledge and insight in food preservation is thus an absolute requirement in order to preserve food-based art. A collaborative approach, based on interdisciplinary work between conservators and food scientists, is key for the preservation of food-based art.



## Chapter 5. Preservation Techniques from the agro-food industry: Implementation possibilities and limitations

### 5.1. Microbial aspects of food preservation

The preservation of food is mainly based on the alteration of one or several intrinsic, extrinsic and implicit parameters. Reduction of pH, reduction of  $a_w$  and modification of  $E_h$ , are frequently used in the food industry to control microorganisms in food. The reduction of pH inhibits spoilage microorganisms. This pH reduction can be realised by adding acids. Some food products undergo lactic acid fermentation in order to reduce the pH microbiologically. Examples are: milk (yoghurt), meat (dry sausages) and vegetables (sauerkraut). The  $a_w$  of a food product can be lowered by the evaporation of water ( $H_2O$ ), and/or, by adding solutes, like salt and sugar. The modification of  $E_h$  can be obtained by the addition of additives, such as nitrite (which has an antioxidative effect and decreases the  $E_h$ ) or vitamin C (which is an antioxidant), or by the removal of  $O_2$ . Also, the concentration of  $O_2$ , surrounding a food product, has an effect on the  $E_h$ . For instance, the outer parts of food products stored in air often have a higher  $E_h$  than the inner parts, which can have an influence on the growth of microorganisms (Devlieghere et al. 2011). The knowledge about the control of the above described intrinsic parameters give conservators insight into preservation possibilities for food used by artists. Furthermore, it helps them to understand how food can be reproduced in order to last longer, when artworks are recreated. In order to maximize the shelf life of food products, the food industry uses many techniques that retard spoilage. Apart from changing the above discussed intrinsic parameters, food technologists apply chemical, thermal and physical preservation methods, to ensure or prolong the microbiological stability of food. These will be discussed in the following paragraphs.

### 5.2. Chemical preservation

Chemical preservation methods are characterized by the addition of chemically substances. In the art conservation profession, intensive chemical preservation treatments, including the application of liquid biocides and fumigation with gases, has been performed. The number of products suitable for cultural heritage is limited, because only a small number of agents have been tested with respect to their compatibility with historic materials. Only a few studies exist on the long-term effects of the biocides, such as possible colour changes or the formation of degradation products (Sterflinger & Pinar 2013). Biocides destroy moulds, bacteria and fungi, all sources of biodeterioration. The role of

biocides in the destruction of microorganisms and, thus in the process of preservation, restoration and conservation of art materials (such as paper, stone, paintings, textiles), has been studied (Cappitelli et al. 2004, Roman et al. 2011, Roman et al. 2013). In the food industry a variety of biocides are used to disinfect food production and processing areas, to disinfect the equipment and to decontaminate carcasses. Disinfectants for the use on food contact surfaces should ideally be effective against different kinds of bacteria and against the majority of mould spores and/or bacterial spores. Four types of disinfectants are currently approved to use in the food industry: chlorine-containing compounds, iodine-containing compounds, quaternary ammonium sanitizers and certain types of surfactants. Those chemical products are not used on the food products themselves (Devlieghere et al. 2011).

Fumigation with gases, such as methyl bromide, methyl iodide, ethylene oxide, methyl bromide/ethylene oxide mixture, propylene oxide and sulfuryl fluoride, were investigated in an attempt to inhibit degradation on quite a lot of food-based and other artworks. Fumigant effects on protein-based materials were examined and compared with those of non-chemical pest-eradicating measures (Derrick et al. 1990). The responses to fumigants with ethylene oxide and gamma radiation (see below physical preservation) have been used to treat the artworks against fungi and their spores (Butterfield 1987, Adamo et al. 1998, Nittérus 2000, Sterflinger & Pinar 2013). Fumigation, in order to treat the insect activity on food-based artworks by Dieter Roth, Claes Oldenburg and Anselm Kiefer (see chapter 3), were performed. The biocidal effect of a fumigant depends on, the concentration that reaches the specific insect and, on the time that the fumigant is present and, on the physiological response of the species. Certain stages of insect development, such as the egg, have slow metabolic processes, which require a longer exposure time (Derick et al. 1990, Kigawa et al. 2011). Temperature and humidity also affect the efficacy of a fumigant. Depending on the insects that have to be treated on a specific kind of artwork, different fumigants are more efficient than others. For instance, at several exposure lengths and temperatures, sulfuryl fluoride was found to be more toxic for beetles, than at the same concentration of methyl bromide (Derick et al. 1990, Kigawa et al. 2011).

Next to the use of biocides and fumigants, some artists and/or conservators treated food-based artworks with synthetic resins, e.g. binders, consolidants or protectives. It is generally accepted that synthetic resins are less prone to chemical, physical and biological deterioration. For instance, Scheidemann used paraloid B 72 for the preservation of the



artwork *Strange Fruit* by Zoë Leonard (see next chapter, experimental study). Paraloid B72 is often applied for the strengthening of natural stone, plasters, wood or other art materials. It is useful for basic impregnation and reinforcement of wall paintings and pictures. It is also applied as fixative for graphics, for chalk, coal and pastel paintings, as adhesive for glass and ceramics and for the consolidation and conservation of wood. Paraloid B72 is particularly favoured by conservators for its long-term stability, under conditions of normal exposure (Horie 1987, Nugari and Priori 1985). Furthermore, the private art conservator, Christian Scheidemann, used acrylic resins as fillers and/or coatings (e.g. after decreasing donuts belonging to a food-based artwork *Bag of Donuts* by Gober). All those art preservation techniques are not used by the food industry, as those kinds of chemical treatments change the intrinsic parameters of food products. In other words such treatments are comparable to plastination (Munoz Vinas 2010). They imply that the treated food materials cannot be eaten anymore. As those treatments change the material properties of the food, they are not reversible treatments and they do not respect the physical integrity of 'real' food-based artworks. All those intensive chemical techniques could be seen as direct preservation treatments (Figure 4, introduction). The specific knowledge to preserve food-based art has to be more experienced by art conservators.

Chemical food preservation methods used in the food industry can be based on lowering the  $a_w$  by the addition of sugar or salt, by dehydration, or by the addition of substances with an antimicrobial activity. The former was discussed before, so in this paragraph the addition of antimicrobial substances will be discussed. The antimicrobial activity of chemical preservatives, such as a variety of organic acids, is influenced by the pH and the distribution between the aqueous and lipid fraction of food. There exist different lists of organic acids, which are allowed for certain food products. Among them lactic acid, citric acid, gluconic acid and their salts can be used at unlimited levels. However, for fresh meat, fish and vegetables, these acids are not allowed (Devlieghere et al 2011).

Certainly, food industrial preservation techniques can offer solutions to preserve food-based art without changing the intrinsic properties of the materials. For instance, the application of preservatives in food products has a long history, such as the use of spices that can be regarded as natural preservatives. Next to such preservatives, there are some other chemical methods that are used in the food industry. Extremely interesting for the conservation of food-based art are food-packaging techniques, involving the creation of anoxic environments or, techniques that lower

the oxygen concentration in a package. These packaging techniques are especially interesting, as they act primarily on the environment in which food products are stored, and their impact on the food is restricted. In this sense, implementation of such environmental preservation techniques in art conservation, are valued, because of the respect for the 'original' material and for the 'touch' of the artist. Furthermore, these techniques are not only interesting for the preservation of food materials, but also for other artist materials. As already mentioned before, oxidation processes, caused by an artwork's environment, can occur in all kinds of materials. New art materials, such as plastics and especially food, appear to deteriorate faster than other materials in museum collections. For artworks, environmental preservation, involving the removal or reduction of parameters that cause or accelerate degradation, proved to be very effective. In the food industry, gas-based techniques and active packaging techniques are frequently used for the preservation. These techniques are perfectly implementable into art conservation.

### 5.2.1. Gas based preserving techniques

The food industry uses in many cases gas-based preserving techniques to extend the shelf life of food. The atmosphere surrounding a food product (air) is modified with the purpose of reducing the oxygen concentration. The shelf life is increased considerably as a result of a reduction in the rate of chemical oxidation by oxygen, and in the growth of aerobic microorganisms, which are the major causes of food spoilage (Philips 1996, Devlieghere et al. 2011). Two types of gas preservation techniques are applied for food products: modified atmosphere packaging (MAP) and controlled atmosphere storage (CAS).

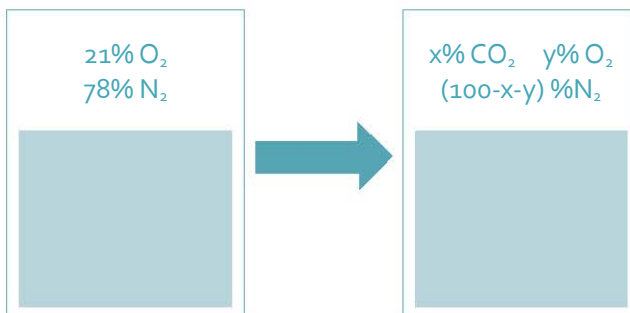


Fig. 35 Principle of gas-based preserving technique

MAP may be defined as the enclosure of food products in gas-barrier materials that change the gaseous environment around the food (Devlieghere et al. 2011) (Figure 35). One of the bottlenecks in MAP is defining the optimal gas atmosphere for a food product in combination with a specific packing design. Different mixtures of N<sub>2</sub>, CO<sub>2</sub> and O<sub>2</sub> gases are required for different products. N<sub>2</sub> is inert and typically used as filling aid, because of its low solubility in water and in lipids, in comparison to that of CO<sub>2</sub> (Phillips 1996). CO<sub>2</sub> is typically an antimicrobial agent and, clearly has an impact on the microbiological spoilage. CO<sub>2</sub> expels the O<sub>2</sub> from the package, and in this way the growth of aerobic microorganisms is inhibited. It is also used to replace air, to prevent oxidative flavour in some dry products, e.g. coffee, or it is used for insect and pest control in the packaging and storage of cereals and grains (Ooraikul 2003). O<sub>2</sub> is applied for the packaging of fruits and vegetables, to prevent anaerobic spoilage, for the packaging of living shellfish, to extend their survival and, for the packaging of fresh meat, for the retention of the colour of red muscle tissue (Devlieghere et al. 2011). The optimal atmosphere depends on: the intrinsic parameters of the food product (e.g. fruits and vegetables may still respire and consume oxygen), the gas/product volume ratio in the chosen containment and, the permeability of the packaging material (Devlieghere et al. 2011).

When controlled atmosphere storage (CAS) is applied, the food products are stored in a closed space and the concentration of gas, initially introduced, is maintained throughout the storage period. For instance, this is applied for the large-scale storage of bulk packed fruits for several months (e.g. for the storage of apples). When a modified atmosphere is used, the amount and/or composition of gas are altered in a gas permeable containment.

A variation of MAP is Equilibrium Modified Atmosphere Packaging (EMAP), which is used for the preservation of fruits and vegetables. This kind of packaging technique slows down the normal respiration of the food to prolong its shelf life. When vegetables and fruits are packed, the gas atmosphere of the package usually consists of a lowered level of O<sub>2</sub> and an increased level of CO<sub>2</sub> (Jacxsens et al. 1999, Jacxsens et al. 2004). The packaging material, used for fruits and vegetables, is especially crucial in regards to how permeable or breathable the material is. If the food is sealed in an airtight package, O<sub>2</sub> will soon become depleted and undesirable anaerobic conditions could develop. But, if the packaging material is too porous, the modified atmosphere will release, and no benefit will be derived. Here, O<sub>2</sub> and CO<sub>2</sub> can pass between the inside and

outside of the package in such a way, that as  $O_2$  is consumed within the pack, it is replaced by oxygen from outside, and similarly, a constant level of  $CO_2$  is maintained. An advantage of this kind of modified atmosphere is that it reduces the natural production of a gas, called ethylene. Ethylene speeds up the ripening process (Jacxsens 2004).

Food product	Preservation technique / gases	T °C	RH	Notes
Butter, coffee, chocolate, bread and pastries, cheese, cereals, raw eggs	MAP: 100% $N_2$	4	60-70%	These are food products characterized with a low $a_w$ . Thus they should be protected against moulds. Moulds are strictly aerobic, thus these food products should be preserved in a strictly anaerobic atmosphere
Fruits, vegetables, living shell-fish and crustaceans	EMAP: 1-5% $O_{2r}$ 3-10% $CO_{2r}$ rest $N_2$	4-7	irrelevant	These food products respire. Thus the containment in which they should be preserved should not be airtight. This is required to preserve the colour and odour of the food product and is required to avoid microbial deterioration.
Ready to serve dishes	MAP: 50% $CO_{2r}$ 50% $N_2$	4-7	> 60-70 %	The colour of these food products is stabilized. Thus these food products do not require $O_2$ in their containment.
Raw unprocessed meat, meat products, poultry and fish	MAP: 70% $CO_{2r}$ 20% $N_{2r}$ +/- 10% $O_2$	4	> 60-70 %	In order to guarantee colour stability a minor quantity of $O_2$ is required in the containment.

Fig. 36 Gas-based preservation for different food types

For food materials that are not consuming oxygen or significantly emit gases, a high barrier material, which has a very low permeability with respect to all gases, is considered to be suitable, in order to keep a constant protective atmosphere within a containment, as long as possible (Devlieghere et al. 2011). Changes in the composition of the modified atmosphere are however inevitable. Due to the presence of the modified atmosphere, a gradient in the concentration of one or several gases is created between the atmosphere at the interior and the exterior of the packed work of art. This gradient is the driving force of a spontaneous natural phenomenon, which tends to neutralise the gradient and, thus restore the atmosphere inside the packed work. One can only slow down this natural process by using the above mentioned high barrier materials and avoid leakages (Devlieghere et al. 2011). Gas-based preservation is different for every food type (Figure 36).

Creating an anoxic environment or low oxygen concentration has been applied in the field of art conservation. Anoxia has been successfully used for pest management and, has been used for a variety of historic materials (Burke 1996, Elert and Maekawa 1997, Brennan 2008, Heath 2010). The use of anoxia was explored to disinfect insect cases in situ, for pest control of buildings and art objects, and for long-running pest management in museums (Kingsley et al 2001). The effects of long-term anoxic storage on works of art on paper and on textiles have been rendered elsewhere (Heath 2010 and Brennan 2008). Anoxic storage has been investigated and evaluated as an effective method to preserve modern collections, containing plastic and rubber artworks (Shashoua and Thomsen 1993, Shashoua and Ward 1999, Dyer et al. 2011). Although, specifically in the context of displaying art, the application of oxygen-free microclimates has been employed for mummies and other historic materials (Maekawa 1998, Hansen 1998, Iskander 1998, Kishan and Maekawa 1998), its use for presentation of food-based art is rather unusual in the context of contemporary art.

Anoxic storage or display is easily applicable in museum contexts for reasons of its cost efficiency and its rather easy and safe implementation. The reduction in oxygen can be obtained by gas-flushing, a technique in which the desired gas mixture is instilled into the packaging, while the air is expelled. For strong ripening food products (e.g. fruits and vegetables) used in artworks equilibrium modified atmosphere packaging (EMAP) can be used (Devlieghere et al. 2011). It should be noted that, if during the storage of a packed food-based artwork a significant change is observed in the composition of the protective atmosphere, one could consider

opening the package and renewing the protective atmosphere. Also, adding oxygen absorbers (see below) helps to maintain the obtained atmosphere.

### 5.2.2. Vacuum packaging (VP)

Vacuum packaging (VP) is based on the principle of removing air from the package prior to its sealing. It thereby creates a vacuum with minor concentrations of residual oxygen. In the food industry, this technique is often combined with gas-based preserving techniques.

In the case of VP, it is required to use flexible package forms (such as bags made by polyamide foils), as vacuum packaging reduces the volume of the containment. The permeability of the film has also to be considered. The vacuum pack system uses flexible barrier films that have a low permeability to water vapour and to gases, especially O<sub>2</sub>. The conservation of the vacuum inside the package is achieved by the complete removal of air from the headspace and appropriate sealing. However, if the food product contains dissolved oxygen or if the package material is permeable to atmospheric oxygen, oxygen can penetrate and microbiological and chemical deterioration may occur.

VP is commonly used to store dry food (such as cereals, nuts and coffee) over a long period of time. It is also used to store cured and processed meats, cheese, smoked fish and raw peeled potatoes (Hernandez-Macedo et al. 2011). On a more short-term basis, vacuum packaging can also be used to store processed vegetables and liquids, because it inhibits bacterial growth. It is often combined with refrigeration, to give food products a reasonable shelf life (Devlieghere et al. 2011).

In museums, vacuum packaging was used to preserve works on paper, as it reduces the oxidation processes, foxing, moulding and colour changes (Lambert et al. 1992, Lin et al. 2006, Polysenski et al. 2007). For instance, a multifunctional vacuum chamber was developed for the preservation of library materials (Polysenski et al. 2007). It is worth noting that the application of VP for food-based art has to be evaluated, depending on the kind of food product used in the artwork. As VP reduces the volume of the containment, it can affect the form of the food product inside. Mostly, the form of food, that has to be preserved in an artwork, is important for maintaining its function. Therefore, the gas-based preserving techniques, in which oxygen can be reduced, are more suitable for the conservation of food-based art.

### 5.2.3. Active and Intelligent packaging

Active packaging is a type of food packaging with an extra function, in addition to that of providing a protective barrier against external influence. It is intended to improve the quality of the packed food, by absorbing or releasing substances (Claeys et al. 1998). The absorbing systems adsorb unwanted elements, such as oxygen, ethylene, vapour, carbon dioxide and aromatic substances, present in the product. Secondly, there are the systems that release an active agent, such as CO<sub>2</sub>, anti-microbial substances, antioxidants, aroma compounds and pigments, present in the food or in the hermetically sealed atmosphere surrounding the food (Vermeiren et al. 1999). Active packaging systems, which are absorbing substances, can be placed in sachets inside the package of the food product.

In the art conservation profession a lot of attention has been given to the use of adsorbents. The application of adsorbents, such as activated carbon, silica gel and zeolites, are frequently integrated in museum storage. The effect of adsorbents on degradation of several art materials has been studied. Because degradation often involves reactions with O<sub>2</sub>, the removal of O<sub>2</sub> is obtained by using O<sub>2</sub> adsorbents, such as Ageless and Atco. They consist of gas permeable sachets containing iron particles, which bind the oxygen by forming iron oxides. Ageless reduces the oxygen concentration of an airtight containment to 0,01 % or less. Experimental studies on the use of oxygen adsorbents proved that after 15 years the condition of objects made of certain plastics remained almost unchanged (Shashoua 2014). Furthermore, anoxic storage, obtained by using oxygen absorbers, has been investigated during a museum field-trial on ethnographic rubber objects (Dyer et al. 2011). It was furthermore concluded that oxygen adsorbent sachets should be replaced every 5 years, because of slow leakage of air, even when containments are well sealed (Dyer et al. 2011). Such adsorbents were also used separately, or in combination with other of above described packaging systems for the packing of mummies and textiles (Brennan 2008 & Maekawa 1998). Activated Carbon has been used in museum storage to inhibit the degradation of several cellulose nitrate objects. It adsorbs nitrogen oxides, preventing those from participating in autocatalytic breakdown or from corroding metals (Shashoua 2014). Also, the use of adsorbents, which remove water vapour and acetic acid, such as silica gel or activated carbon, are used in museum storage to protect cellulose acetate objects. For instance, silica gel sachets, used in all kinds of packages of commercial objects and food, are frequently used in museums, to control RH by

adsorbing water. In general, adsorbents have a limited effectiveness and become exhausted by adsorbing a wide spectrum of compounds, instead of just one (Sashoua 2014). Therefore, their use is better combined with other food preservation methods in order to support the delay of degradation processes.

Next to active packaging, intelligent packaging, however not a preservation technique in itself, is worth mentioning in relation to active packaging. Intelligent packing systems are indicators for packaging, so that temperature, freshness of the food product and the modified atmosphere in the packaging can be controlled (Dobrucka et al. 2014). Examples of intelligent packaging are:

- Time-temperature indicators (TTIs): these indicators are attached to the packaging of a food and integrate the cumulative time temperature history of the food, starting from the activation of the indicator. This integrated time temperature history is visualized through a change in colour. Besides these cumulative TTIs, there are also temperature indicators on the market indicating the exposure above, or below a critical temperature.
- Freshness indicators: these indicators show the current quality of a food product, based on a physical reaction between the indicator and the metabolites (breakdown products) produced, during the growth of microorganisms of the food product.
- Leakage indicators: these indicators exist in the form of a tablet, a printed layer or as a lamination in a polymer foil. They are often used in MAP to prevent leakage of the package.

The use of TT and leakage indicators was applied in combination with active packaging techniques for the preservation of diverse museum objects (Maekawa 1998, Weintraub 2006, Brennan 2008). Monitoring the environment in museums is one of the essential elements in an overall preservation program. Therefore, museum professionals use all kinds of instruments, such as thermometers (gives temperature information), humidity indicators strips or colour cards (for humidity-monitoring), psychrometers (measures RH), hygrothermographs (keep the record of highest and lowest temperature and humidity). Also, continuous monitoring devices, such as data loggers that record temperature and RH, are used in museums (Weintraub 2006, Mecklenburg 2009, Ford 2012).



### 5.3. Thermal preservation

Thermal preservation techniques are based on decreasing or increasing the external factor temperature. Low temperature storage for the preservation of artworks has been used and studied (Kingsley et al. 2001, Shashoua 2014). For instance, storage at temperatures below  $-20^{\circ}\text{C}$  will slow all chemical degradation reactions and thereby, slow the rate of breakdown for many plastics in museums (Shashoua 2014). Also, low temperature storage ( $-20^{\circ}\text{C}$  to  $-25^{\circ}\text{C}$ ) has been evaluated as essential for the long-term preservation of photographic collections. At such temperatures, maximum chemical stability and physical safety are achieved. Careful management of the time of photographic material being on display versus the time in storage is crucial to this approach (McCormick-Goodhart 1996).

Furthermore, systematic treatments with cycled freezing were performed on infested ethnographic objects (Kingsley et al. 2001). Wharton et al (1995) described a controlled freezing treatment to eradicate insects on a food-based artwork by Oldenburg (see chapter 3). Although these techniques proved to be useful to eradicate pests, it should be noted that for long term preservation of food-based art, alternate freezing and thawing is unfavourable for the quality of food materials. The texture of food could change and be damaged (Devlieghere et al.).

Because temperature controls the rate of physico-chemical reactions, it has a profound effect on the biological systems in food. The conservation temperature for food is one of the main factors determining their durability. Microorganisms can grow in temperatures between  $-18^{\circ}\text{C}$  and  $70^{\circ}\text{C}$ . To preserve food, and thus inactivate the microorganisms or slow down their growth, changing the environmental temperature is useful. Reducing the temperature, by using techniques such as chilling (reduction of  $T$  to  $-1$  to  $+7^{\circ}\text{C}$ ) and freezing (below the freezing point of the food product, which is different for each food product), are favourable for the preservation of food in the industry (Devlieghere et al. 2011). Also, heating at temperatures around  $70$ - $80^{\circ}\text{C}$ , used in the food industry, can lead to complete inactivation of microorganisms in food (Devlieghere et al. 2011).

It is worth noting that in the case of food-based art, the use of low temperatures, such as described above, can cause a number of irreversible physiological changes in microorganisms. A strict condition for the use of low temperature is the continuity of cold  $T$ , which is in the

case of food-based art plainly impossible, as artworks move from storage towards display environments. Additionally, thawing of packaged food in their packages causes condensation on the surface of a food product, which results in accelerated microbial growth. Also increasing the temperature to preserve food-based art is unfavourable, as this method has numerous effects on a cell and pasteurization causes a limitation of the shelf life duration (Devlieghere et al. 2011).

Instead, temperature stabilization is very useful to prolong the shelf life food-based artworks. This method is perfectly manageable in a museum environment without the need of special instrumentation. Especially, for those works that are intended to perish, and for which conservators try to respect the artist's intention (by not treating the food products themselves) temperature stabilization proved to be effective. The application of temperature stabilization has already proven its efficiency for food-based art. Wharton et al. (1995) described how the work *Two Frauleins with shining Bread* by Joseph Beuys, containing chocolate covered with oil paint, which developed fat bloom, was preserved by the Canadian Conservation Institute. The chocolate was left untreated, but they placed this food-based artwork in a permanent display case with very little air volume at ambient gallery environmental conditions of 45% RH and 21°C (Wharton et al. 1995). Indeed, the most important factor in chocolate art preservation appeared to be the maintenance of a stable temperature of 20°C, which is a realistic in museum environment (Wharton et al. 1995).

#### 5.4. Physical preservation

There are several physical methods used for the analysis and assessment of art objects. The applications of these methods include to deterioration detection, authentication, revealing forgeries and fakes, and attribution, but are not limited to these only. Especially non-destructive methods are used, such as those that have been developed for the authentication of paintings. These methods are used to inform conservators on the preservation possibilities of paintings, such as multi-spectral illumination methods, Raman spectroscopy and imaging, and Mass-spectroscopy. As those methods are not used in the food industry they will not be discussed in this paragraph.

Physical methods used in the food industry are: pasteurization, dehydration and irradiation. Physical food preservation means that the food product is subjected to a physical measure that counters microbial growth.

#### 5.4.1. Dehydration

Dehydration is used in the food industry to lower the  $a_w$  of a food product, and thus, to prolong the shelf life of food products. Two types of such preservation methods can be used: conventional drying and freeze-drying. When using conventional drying (hot air), the dehydration occurs in the form of evaporation, and ideally results in the extraction of water from the product. The rate of dehydration depends, among other factors, on the temperature used to dehydrate. Another technique is freeze-drying, a technique in which firstly the water inside a food product is frozen and, secondly the ice is converted into vapour, leaving a dry product. (Devliegere et al. 2011). Due to the absence of liquid water and the low temperatures required for the process, most of deterioration and microbiological reactions are stopped, which gives a final product of excellent quality. The solid state of water during freeze-drying protects the primary structure and the shape of the products, with minimal reduction of volume (Ratt 2001). As stated before, the minimum  $a_w$  for microbial growth in food is also determined by other determining conditions, such as pH and T.

#### 5.4.2. Pasteurization and other heat treatments

A relatively mild physical treatment is pasteurization, which affect microbes causing diseases or spoilage. It is a process of heating, and then rapidly cooling, to prevent spores from germinating. More aggressive treatments are required to affect the spores, such as sterilization. However, such more intense heat treatments typically affect a variety of other quality indicators of foods (e.g. colour, texture, nutritional value, etc.) (Paulus 1985).

#### 5.4.3. Use of radiation

Food irradiation is an intensively studied mild food preservation technique. More information on the technology can be found in a number of reviews (Loaharanu 1995, Farkas and Mohacsi-Farkas 2011). It is established as a safe and effective method of food processing and preservation. This physical conservation technique is recognized as an alternative method to fumigation of food, to control insect infestation and microbial contamination (Loaharanu 1995). The working principle is based on the lethal effects of high frequency, and thus high-energy rays, which eradicate microorganisms. The various radiations are separated on the basis of their wavelengths ( $\lambda$ ), with the shorter  $\lambda$ , being the most

effective. Radiations of interest for food preservation are: ultraviolet rays (UV) and ionisation rays. Two types of ionising radiation can be used for the irradiation of food products: beta ( $\beta$ )-irradiation and gamma ( $\gamma$ )-irradiation (Devlieghere et al. 2011).

UV-rays have a powerful bactericidal agent, with the most effective  $\lambda = 260$  nm. UV-rays with  $\lambda < 200$  nm do not show any antimicrobial activity and are absorbed by atmospheric  $O_2$ , which is converted into undesired ozone ( $O_3$ ). The poor penetrative capacities of UV-rays limit the use of this treatment for food. They are more used for decontamination of food surfaces or the surrounding air. They are sometimes used to treat the surfaces of baked fruitcakes and related products before wrapping (Jay et al. 2005). Sometimes packaging materials are irradiated with UV-rays to disinfect them (Van Calenberg et al. 1999). Furthermore, UV-rays may catalyze oxidative changes that lead to rancidity, discolorations and other reactions of the food, which limits their application on food.

$\beta$ -rays can be defined as streams of high energy electrons (beta particles), produced by an electron gun that can be turned on and off, and does not produce radioactivity. These rays possess poor penetration (3-4 cm) power into food. Electron beam irradiation has been used to disinfest grain and to control insects on fruits, vegetables and other food (Devlieghere et al. 2011).

$\gamma$  Rays are electromagnetic radiations emitted from the unstable nucleus of elements, such as  $^{60}Co$  and  $^{137}Cs$ , which are of importance in food preservation. This is the cheapest form of radiation for food preservation. Those rays have excellent penetration power, as opposed to beta rays.  $^{60}Co$  has a half-life of about 5 years (the half-life for  $^{137}Cs$  is about 30 years). The advantage of gamma radiation is that  $^{60}Co$  and  $^{137}Cs$  are relatively inexpensive by-products of atomic fission. In a common experimental radiation chamber, implying these elements, the radioactive material is placed. Materials, to be irradiated, are placed around the radioactive material (the source) at a suitable distance for the desired dosage. Irradiation at desired temperatures may be achieved, either by placing the samples in temperature-controlled containers, or by controlling the temperature of the entire concrete- and lead-walled chamber. Among the drawbacks to the use of radioactive material, the isotope source emits rays in all directions and cannot be turned "on" or "off", as may be desirable. The use of electron accelerators offers certain advantages over radioactive elements that make this form of radiation somewhat more attractive to potential commercial users (Van Calenberg et al. 1999).

In the food industry, microbial cells are irradiated with 10 kilo Grays or less, corresponding to an amount of energy absorbed by 1 kg of the irradiated food amounting up to 10 000 Joules. Such doses lead to a significant prolongation of the products' shelf life. When a food product is irradiated, the temperature hardly increases at all. This allows raw food products to be irradiated, without any loss in nutritional value and, without changes in colour, smell, flavour and/or texture (Baert et al. 2009). It should be noticed that at higher irradiation doses, chemical changes do occur in food, but these are not necessary to reach the desired microbiological stability.

With food products in contemporary art, higher doses could be applied. At higher doses (e.g. 25 kilo Grays), the more resistant microorganisms will be inactivated, implying a better stability of the product (Van Calenberg et al. 1999). It should be noted that food products rich in fats are less suitable for irradiation, since irradiation may cause significant lipid oxidation and rancidity (Ahn and Love 1999). Irradiation is not implementable in a museum environment, as the instrumentation needed is only available in specialized centres. Moreover, artworks should be sterilised in a closed container or package. Furthermore, once the work is taken out of its containment, it loses its sterility and becomes vulnerable again for microbiological spoilage.

Gamma radiation was used for decontamination of cultural heritage objects made of organic materials such as paper, parchment and wood (Negut et al. 2012, Sterflinger and Pinar 2013, Michaelsen et al. 2013). Negut et al. (2012) recommends gamma irradiation as a reliable decontamination treatment for historical pigments. Individual art objects and even a large amount of art objects can be treated quickly and at relatively low cost. Despite these advantages, its application is rather unusual in the context of art conservation, because of conservators their reluctance (Negut et al. 2012).

### 5.5. Hurdle technology and combination approach applied to food-based art

In earlier days, food preservation relied on highly intensive stresses for microorganisms, such as very low pH,  $a_w$  or intensive heat treatment, which resulted in almost complete elimination of present microorganisms, or inhibited their possible growth. Nowadays, intensive food treatments are not always applied, because of consumer requirements and, thus remain microbiologically unstable. The food industry relies more and more on the preservation by combined processes, in which the considered

parameters are part of a dynamic system that changes from the moment of application to the moment of consumption. To apply the principles of food preservation by combined processes correctly, understanding the mechanisms of action of the individual parameters alone, and in combination, is needed (Devlieghere et al. 2011). This approach, known as the hurdle technology (synonymously called combined methods, combined processes, combination preservation, combination techniques, barrier technology, or hurdle technology), proved to be very successful, since an intelligent combination of hurdles secures the microbial stability and safety, as well as the sensory, nutritive, and economic properties of a food (Leistner).

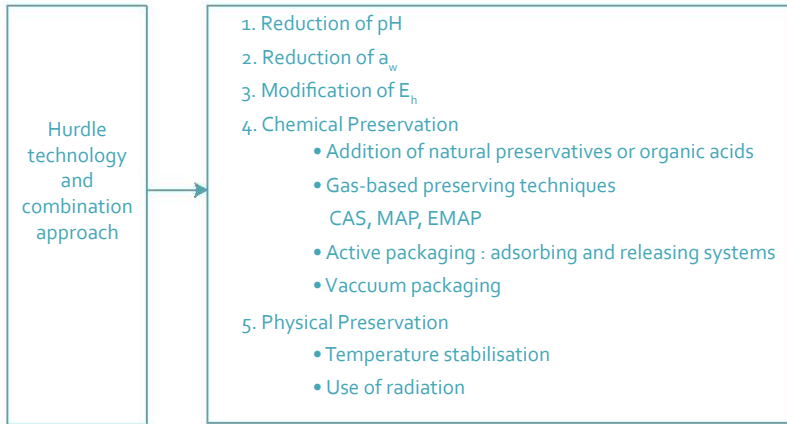


Fig. 37 Hurdle technology and combination approach

For the development of preservation strategies for food-based artworks, conservators should thus work together with food scientists and balance the different parameters and possible strategies to preserve the food or to reconstruct certain food products. Interesting for the preservation of food used in contemporary art, is a combination of the hurdle technology (which is used to secure microbial stability) and the technique used to secure the chemical stability (Figure 37). For instance, the food can be packaged under a MA (with the right gas composition) and adsorbents can be added, affording the food product some chemical protection. Afterwards, the packed food could be irradiated. Irradiation combined with MAP could be very useful for the preservation of food-based art, as it is a technique that stabilizes the condition of the food. Worth noting is that, when the work of art is removed from the packaging, and re-exposed to the air, the food product becomes contaminated again (Devlieghere et al. 2011).

## PART 3: ART & FOOD: TRANSLATION TO CONSERVATION PRACTICE

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### Chapter 6: Experimental study: Modified Atmosphere Packaging (MAP) and irradiation: 3 case studies

Parts of this chapter are published in:

Gilman J., Jacxsens L., Demeulenaer B. & Devlieghere F.: Modified atmosphere packaging and irradiation to preserve contemporary food-based art: an experimental study. *Journal of Cultural Heritage* (in press)

Gilman J., Van Damme C., Demeulenaer B. & Devlieghere F. (2011): MAP as a conservation method for contemporary art with foodstuffs: three case studies - *CeROArt* 7 (On line, <http://ceroart.revues.org/2207>)

#### 6.1. Packaging designs, experimental data and instrumentation

##### 6.1.1. Packaging designs and accelerated ageing

To examine the preservation possibilities for 3 food-based artworks, *Butter and Beeswax* by Joseph Beuys, *Eggs* by Peter De Cupere and *Strange Fruit (for David)* by Zoe Leonard, a number of test samples were created, to subject them to accelerated ageing. Traditional food preservation techniques, MAP and irradiation, were used to evaluate packaging designs for long-term conservation management. In order to preserve food-based artworks, different aspects were considered, when defining the package: the deterioration processes of the food materials and non-food materials as well as the combination of the materials.

The packaging materials, used for the MAP experiment, were Plexiglas (polyacrylate) boxes, specially constructed for the purpose of the experiment, afforded with a Plexiglas lid and rubber seal. For the irradiation tests, barrier polyamide foils were used, to create bags in which the test samples were stored. To pump the gasses into the containments (boxes and foil bags), two valves were integrated into each side of the receptacles. The containments were filled with the test samples and, in the Plexiglass boxes, the food-based art samples were surrounded with

materials for cushioning artworks (ethafoam and spin polyester) (Figures 37.-40). The reason for using Plexiglas boxes and barrier polyamide films in these experiments is that those materials offer a good barrier towards  $O_2$ ,  $N_2$  and  $CO_2$ , (Devlieghere et al 2011). Moreover, Plexiglas is resistant to mechanical damage and could be used as main containment for storing the artworks. The barrier polyamide bags could be integrated into museum storage cases.

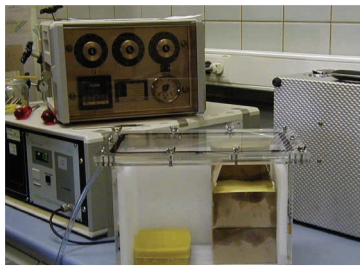


Fig. 37 Sample *Butter and beeswax* in Plexiglass box

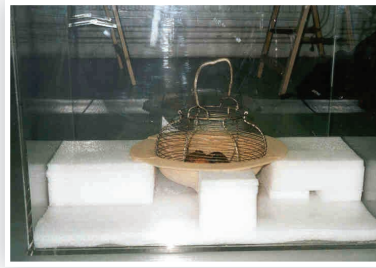


Fig. 38 Sample *Eggs* in Plexiglass box



Fig. 39 Sample *Eggs* in polyamide foil

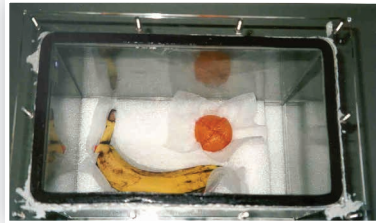


Fig. 40 Sample *Strange Fruit* in Plexiglass box

For each case, one of the test samples was stored under MAP conditions, while another, serving as reference test sample, was not (air conditions). The modification of the atmosphere in the packages was carried out with a gas-packaging unit (gas mixer, WITT M618-3MSO, Gasetechnik, Germany) (Jacxsens et al 2002). Air products (Vilvoorde, Belgium) supplied the gases. The composition of the headspace was measured during the flushing period, by using a  $CO_2/O_2$  gas analyzer (Servomex food packaged, series1400, UK). Afterwards storage was started (time 0).

Two extra test samples of the case *Eggs* were irradiated at room temperature ( $21^\circ C$ ), with the '15 MeV linear accelerator' of the Department of Subatomic and Radiation Physics at Ghent University (Mondelaers et al. 1995). This accelerator delivers electron beams with



a well-defined energy and range of 3 and 15 MeV and, with an average power up to 30 kW. Firstly, one sample was packed under the MAP conditions in a sealed barrier-polyamide foil and, afterwards, irradiated. The other sample was firstly irradiated and, then, packed within the barrier-foil, in which the atmosphere was not modified (air conditions). Afterwards, both bags were submitted towards accelerated ageing, in order to evaluate irradiation only and, its combination with MAP.

#### Case Joseph Beuys and Zoë Leonard:

	T	RH	Light
Clime A	4-5°C	50%	0 lux
Clime B	20-25°C	30%	2363 lux

#### Case Peter De Cupere:

	T	RH	Light
Clime A	30°C	20%	0 lux
Clime B	6°C	76%	5 lux

T = temperature

RH = relative humidity

Fig. 41 Conditions of the acclimatized rooms

To accelerate the ageing process, all test samples were stored for 2 to 3 days in two acclimatized rooms (Figure 41). For the cases *Butter and Beeswax* and *Strange Fruit*: room A (4-5°C, 50% RH and 0 lux) and room B (20-25 °C, 30% RH and 2363 lux). For the case *Eggs* bigger acclimatized rooms were needed, because bigger containments were used for the MAP experiment: room C (30°C, 20% RH and 0 lux) and room D (6°C, 76% RH and 5 lux). By storing the samples under different conditions of temperature, RH and light, the normal aging processes of the food products were sped up. Accelerating ageing tests helped to determine the long-term effects of expected levels of stress within a shorter time.

#### 6.1.2. Determination of the visual and sensory quality

All the test samples were evaluated visually, under daylight, in a descriptive manner every 2 to 3 days: structure and colour evolution (by comparing to the freshly made replicas of the artwork) and mould development (being

visual mycelium present or not) under both conditions. A gas sample (from each MAP test sample) was taken periodically through an airtight septum and analyzed by gas chromatography, as described by Van der Steen et al. (2002).

To determine the degree of oxidative rancidity of the butter (case *Butter and Beeswax*) and the baked chicken skin (case *Eggs*), the peroxide value (POV) on isolated lipid was determined from a sample (AOCS official Method Cd 8b-90, 1989). The lipid from the sample (obtained after melting and centrifuging the fat) was extracted with petroleum ether. The POV of an oil or fat is used as a measurement of the extent to which rancidity has occurred during storage. It is defined as the amount of peroxides (meq) per kilogram of fat or oil (Devlieghere et al 2011).

### 6.1.3. Determination of the microbial counts

The growth of relevant spoilage microorganisms for the baked chicken skin of the test samples (case *Eggs*) could be monitored, using classical enumeration methods. In this case after opening the packages (day 49), a dilution series was performed and the microbial level of the baked chicken skin was determined. Samples were pour-plated and spread-plated on specific media.

Total aerobic psychotropic count (TPC), indicating the level of microorganisms in a product, was pour plated on plate count agar (PCA, Oxoid, CM325) and incubated at 22°C for 5 days.

Lactic acid bacteria (LAB) LAB were also counted, as they produce predominantly lactic fermentation, causing decay (when  $> 5.10^7/g$ ) on heated poultry (Devlieghere et al. 2011). In some cases LAB can have a positive effect, as it is added for the production of e.g. cheese and yoghurt (Devlieghere et al 2011). LAB were counted on a plate with a top layer of de Man, Rogosa, Sharpe agar (MRS, OXOID, CM361) after 3 days of incubation at 30°C.

A spread plate with oxytetracycline glucose agar (OGA, Diagnostics Pasteur, Marnes-la-coquette, France, 64894) with an additional supplement (oxytetracycline supplement, Oxoid SR073A) was used to allow enumeration of yeasts (after 3 days of incubation) and moulds (after 5 days).

## 6.2. Joseph Beuys: Butter and beeswax, basic material 4bis (1975, S.M.A.K.)

### 6.2.1. Creating context for conservation

Joseph Beuys (1921-1986) occupies a prominent place in the history of food-based art. Along with Dieter Roth, he pioneered the practice of transformation in artworks through the use of decaying food materials. Joseph Beuys' works need to be interpreted in their historical context as several of the materials Beuys worked with, the way he produced his art and the intention he had with his work can be traced back into a meaningful statement (Wharton et al 1995, Barker and Bracker 2005).

Beuys was an inveterate storyteller and created his own mythic biography, fusing his art and life into a fictionalized narrative structure. His entire artistic practice evolved from a personal myth in which he described an apocryphal near-death experience and his subsequent regeneration. According to this myth, Beuys survived a plane crash because Tartars took care of him. They would have covered his body in fat and wrapped him in felt to keep him warm. As he regained consciousness, the smell of the fat and the felt appeared to awaken his inner artist. Beuys' use of fat, felt and wax in his art were symbolic markers for the concept of renewal, which he expanded from the idea of that personal rebirth in order to awake worldwide political and social problems (Wharton et al 1995, Aben 1995, Raap 2002, Barker and Bracker 2005, Spector 2006, Barker and Smithen 2006, Van Damme et al 2006, Wittocx 2006, Buschmann et al 2009). The question of truth-faithfulness of this myth is irrelevant here. Important is that this story inspired Beuys to create several remarkable food-based works of art. This story was not just an inspiration for his work, but also a statement of his belief in humanity's ability to survive if people cared for one another.



Fig. 4.2 Joseph Beuys: *Butter and beeswax, basic material 4/b*, 1975, S.M.A.K.

The problem with Beuys' position on decay, change and damage was that it varied from statement to statement and from piece to piece (Barker and Bracker 2005). In order to understand and preserve Beuys' artworks, his particular interests and associations in the specific artwork should be investigated (Grün 2006). In the case of *Butter and beeswax, basic material 4/b* (Figure 4.2), the artist didn't specify in which way this work could change and what exactly would involve damage. In this case, the only possibility was to rely on the documentation S.M.A.K., recorded at the time of its acquisition, on

the statements by Beuys concerning the preservation of works, containing the same materials, on the previous preservation decisions of similar works and, on the discussions between conservators, curators and the artist's estate.

The artwork *Butter and Beeswax, Basic material 4/b* was created in 1975 and comprises 4 cardboard boxes, with 40 packets of butter in each box and, a single pile of 7 staked beeswax plates, in a display case. This sculpture was produced in Ghent, when the then director Jan Hoet decided to acquire some of Beuys his works. Beuys used plain dairy farm butter in cardboard boxes from the Belgian factory Campina (Aalter) nearby Ghent. The display case was an old-fashioned case that he found in the museum (Hoet 2000). According to the description of the work in its conservation report, this work remained unfinished till the artist's death (Huys 2008). Just like in many of Beuys his artworks, the artist never saw his work as finished, so that he could intervene and change his work when he wanted (Barker and Bracker 2005, Quaghebuer 2002). Indeed, the fact that the museum holds identical cardboard cases as the ones Beuys used for his work in their storage could mean that Beuys considered changing his work later on. According to Jan Hoet (1936- 2014,) it was possible to interchange the cardboard cases if they would degrade. Hoet estimated that one could recreate Beuys' creation, as long as they use the same materials (Hoet 2000). However, this is contradicted with Beuys his statements and the collaborative discussions with conservators and curators on the interpretation of his works.

The analysis of Beuys his use of fat and beeswax gave more insight towards the meaning of *Butter and beeswax, basic material 4/b*. Beuys began using fat in the 1960s in his *Fat Corners*, such as *Fettecke in Kartonschachtel* (1963) (Figure 19) and in several sculptures, such as *Fat Chair* (a fat cube on a chair, 1964-1985) and *Fat Battery* (1963) (Figure 15) (part 1, Barker & Bracker 2005). To Beuys 'fatty' materials, such as butter, work as sources of energy, emitting and healing power. The melting and hardening butter at different temperatures were needed in order to function, as a work by Beuys. This artist believed in the healing power of nature, which for him consisted entirely of the energy that is produced by the contrast between hard and soft. Fat, in its different forms (as a liquid when warm and a defined solid substance when cold), was an ideal material for Beuys, in order to physically express his intention. Furthermore, he believed that fat was psychologically effective as a nurturing, life-sustaining substance, essential for nourishment and energy uptake (Quaghebuer 2002, Rekow). Beeswax was another substance that Beuys used as the antithetical property of liquid honey. Beuys his interest in this sculptural material was linked with the transformation process of forming solid geometric honeycombs by bees (Rekow). With honey, Beuys referred to the spirit of cooperation in the behaviour of bees, reflecting a harmonious and utopian society. Honey, not only had a connection with nourishment, but it also had a certain mystical quality for Beuys. According to Beuys, honey was regarded as a spiritual substance in mythology and bees were godly. Also, he viewed the organization of bees as very similar to the principles of socialism. Furthermore, both materials fat and beeswax were linked with his mythic biography. From these statements, it could be concluded that the changing shape, in which the materials are decaying, is a necessary behaviour.

Furthermore, several previous analyses on Beuys view on preservation and, consequent decisions concerning their conservation demonstrated that change was integrated in the conceptual framework of most of his work. The anecdote told by the British conservator, Herbert Lank, to the American director for conservation, Carol Mancusi-Ungaro, exemplified Beuys his idea on the originality of one of his materials (Mancusi-Ungaro 2009): *On your point about Beuys possibly not wishing to have his fat and lard look older with time, I recalled a case on this when I used to deal with accidental damage of an artwork of him. The artwork consists of a construction of a German U shaped knackwurst suspended from a rod by shoelaces. Once a large chunk had been bitten out of the base of the sausage. Joseph Beuys, when asked about what to do, replied that a new sausage would not be a solution because the original was by then 10 years old, and that the 'patina' was an essential element of the work.*

The reconstruction of Beuys his work *Fettecke in Kartonschachtel*, purchased in 1972, by the Stedelijk Museum in Amsterdam (discussed in the previous chapter), highlighted the conservator his dilemma in the case of Beuys' work. This reconstruction gave the viewer a purely physical experience, but this work was destroyed in its function. In most of Beuys' artworks the degrading materials were not replaced, as conservators indeed felt that the meaning of his works lay in the 'changing' material. His materials couldn't be interchanged just like that because Beuys underlined in many interviews that for him the patina of his 'original' materials was important (Aben 1995, Wharton et al 1995, Quaghebuer 2002, Raap 2002, Barker and Bracker 2005, Spector 2006, Barker and Smithen 2006, Van Damme et al 2006, Wittocx 2006, Buschmann et al 2009).



Fig. 43 Joseph Beuys: *Butter and beeswax, basic material 4/b*, degradation of cardboard due to fat impregnation.

Most of the interpretations about Beuys his work lead to the idea that all degradation processes are an integral part in this piece. Since conservators became more aware of the importance of the originality of Beuys' materials, they tried to attempt a compromise between 'let the artwork perish' and 'stabilizing it into a longer-lasting state'. (Wharton et al. 1995, Aben 1995, Barker and Bracker 2005,

Barker and Smithen 2006, Van Damme et al. 2006, Mancusi-Ungaro 2009, Munoz Vinas 2009 & 2010). The cardboard cases in *Butter and Beeswax, Basic material 4/b* showed signs of degradation, because of fat impregnation and the staple of cases started to collapse (Figure 43). The cardboard cases found in the storage were in good condition and did not have traces of ageing. Considering Beuys his statement on the patina as an essential element in his work, exchanging the cases with those new ones is not an option. In most of his works, including those with butter, the presence of the fat is more important than its form and, it could be concluded that the changing shape, odour and colour are necessary, in order to respect the artwork's function. In order to preserve the original butter in this case, it is possible to stabilize the artwork into a longer lasting state, by applying food preservation techniques.

### 6.2.2. Deterioration processes and condition of the different parts of the work: packed butter and beeswax

Materials	deterioration	remarks
butter	crumbling melting and fermentation, rancid odour (chemical degradation)	Pressure because of stacking of cardboards in which the butter was packed  Lipid oxidation (fat) processes because of temperature and relative humidity fluctuations and the influence of light, due to moving from storage conditions towards display conditions.
cardboard	deformation and disintegration	Lipid oxidation of the butter impregnated in the cardboard, which results in loss of physical integrity
beeswax	broken (physical degradation)	The plates broke because of manipulation

Fig. 44 Deterioration processes observed on the artwork *butter and beeswax*

*Butter and Beeswax* had suffered many signs of deterioration since its acquisition in 1987 being: crumbling, melting and fermentation of the butter leading to rancid odours and deformation and disintegration of the cardboard because of fat impregnation (Figure 44). As butter is liable to chemical degradation, the butter became rancid after a while, influencing its smell, colour and structure. This is the result of fat oxidation. Beeswax is microbial stable.

To determine the sensitivity of the food products to degradation, one must understand the sensitivity of the butter is to microbial, chemical and enzymatic reactions. As seen before, such reactions can be very matrix dependent. Nevertheless, it is possible to identify some generic intrinsic parameters of food, such as the acidity value (pH, being the  $-\log$  (proton concentration) and the water activity ( $a_w$ ), which enable to predict to some extent their vulnerability to the variety of degradation mechanisms (Devlieghere et al. 2011).

Before starting the tests on the test samples, values of pH and  $a_w$  of the Campina butter used for the experiment were measured. As butter is an acid product ( $\text{pH} < 7$ ), it is sensitive to the development of moulds and yeasts and less sensitive to the growth of bacteria. Although, not yet noticeable on the artwork, moulds and yeasts could develop, because the Campina butter used for the test samples had a low  $\text{pH} = 4,9$  (measured by a pH electrode: Knick pH meter, Berlin, Germany) and high  $a_w = 0,935$  (at  $25\text{ }^\circ\text{C}$ , measured with a cryometer: Typ AWK-20 (NAGY messsysteme GmbH, Gaufelden, Germany)). For the increase of mould and yeast growth a minimum  $a_w$  of  $0,80\text{--}0,65$  is needed (Devlieghere et al. 2011).

The degradation processes visible on the artwork can be explained as follow. The crumbling of the butter was due to the pressure it endured, because of the stacking of the cardboard cases. This, combined with relatively high temperatures (e.g. storage temperature in the museum is  $18\text{ }^\circ\text{C}$ ), made that the butter started melting. Then the fat was absorbed by the cardboard and, was prone to oxidation, a process causing rancid offending odours. Lipid oxidation resulted in changes of the physical texture of the butter and the cardboard. This gave rise to loss in physical integrity of the cardboard and, it disintegrated (Devlieghere et al 2011). Furthermore, obviously, the wax plates were liable to physical degradation, as they were broken. Thus, careful manipulation of the wax plates is required.

To produce the test samples for the experimental research, cardboard boxes were filled with the Campina butter and stapled upon each other. The box on top of the staple was left open, in order to see degradation processes of the butter during the experiment. To produce the wax plates, beeswax was melted and formed into plates (Figure 37).



### 6.2.3. Conservation by S.M.A.K.

Considering the position of Beuys, with regard to other conservation cases (e.g. *Fat battery*, *Fettecke in Kartonschachtel* and others), and based on the concept of evolution and decay processes as part of his 'fat works', conservators at S.M.A.K. decided to interfere as little as possible into the degradation processes. The fragility of the cardboard boxes and the numerous weakened zones and wide opened tears made this artwork delicate in manipulation. Therefore, the cardboard cases were supported in order to prevent the heap of cases from collapsing. The broken wax plates were consolidated, by filling the cracks and, by gluing the broken parts together with melted beeswax (Huys 2008).



Fig. 45 Joseph Beuys: *Butter and beeswax*, basic material 4/b, wooden crate, parts of the artwork wrapped into acid-free paper, cushioned with Ethafoam.

During exhibitions, the work was displayed in its permanent display case. During storage, the cardboard boxes and wax plates were taken out of the display case and were separately wrapped into acid-free paper and then stored into a wooden crate, cushioned with ethafoam (Figure 45). They were stored in an air-conditioned storage area with environmental conditions of 55% RH, 18°C and light intensity kept at its minimum, as this room is accommodated with light timers and dimmers.

#### 6.2.4. Proposition for preservation and experimental study : Modified Atmosphere Packaging (MAP): 100% N<sub>2</sub>

For the work *Butter and Beeswax*, storage in MAP (100% N<sub>2</sub>) conditions could offer a solution in prolonging the lifetime of the artwork, without intervening in the idea of the patina (Figure 46).

Materials	deterioration	preservation	remarks
butter	physical degradation microbial growth (yeasts, less bacteria) mould growth lipid oxidation (fat) rancidity	MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary  adding absorbers and/or scavengers will help to maintain optimal gas environment  repackaging after exhibition
cardboard	physical degradation fat impregnation lipid oxidation (fat)	MAP, excluding oxygen (100% N <sub>2</sub> )	Same as above
beeswax	physical degradation	-	-

Fig. 46 Overview of degradation processes and preservation possibilities for *Butter and beeswax*

The artwork should be protected against oxygen, which stimulates the growth of bacteria and moulds. Especially, the butter, liable to chemical degradation (oxidation), should be protected against O<sub>2</sub> stimulating the growth of bacteria and moulds. During the experiment, N<sub>2</sub> was used in MAP to displace O<sub>2</sub> to delay oxidation, slow down the growth of aerobic spoilage organisms and performing as a filler to maintain package conformity.

Furthermore, the storage temperature for the butter should be between 4-7°C to avoid rancidity and melting (Devlieghere et al 2011). The RH should be at 93% because butter has a high  $a_w$  (Devlieghere et al 2011). Normally, cardboard and wax can be stored in an air-conditioned storage area in which RH is kept at 55% and T at 18°C, such as in this museum.

The biggest problem for this case was the combination of the cardboard boxes filled with butter. As the ideal temperature and RH values do not correspond for the different materials, it is valuable for conservators to strive for a stable environment and maintain a RH = 60-70% and, a maximum temperature of 16°C. Light should be excluded as much as possible. This kind of preventive storage will help to slow down all degradation processes.

#### 6.2.5. Results and discussion: visual and sensory decay

After 62 days of experimenting, there was visually no decay and no mould development perceptible on the beeswax. There was neither mould development on the butter and the fat impregnated cardboard. The course of the development of the colour, structure and odour of the fat is tabulated (Figure 47).

After 36 days, the fat in the MAP box had a rancid odour and colour. Then, the gas composition was measured and appeared to be similar to the surrounding air of the reference test sample. Apparently, there was a leak in the sealed box. Therefore, the box was reflushed with 100% N<sub>2</sub>. The fat in the test sample, exposed to normal air conditions, became rapidly rancid. After 15 days of storage, the structure, colour and odour of the fat had changed already, which was then not the case for the MAP packed test sample. After the reflushing of the MAP test sample, the rancidity process obviously slowed down.

Time/ d (Clime)	Air (reference sample)			MAP (sample)					
	Colour	Structure	Odour	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	N <sub>2</sub> (%)	Colour	Structure	Odour
0(I)	n	n	n	0	0	100	n	n	n
5(A)	more yellow	id	id	-			yellow (less than in air)	id	-
7(B)	id	crystalloid deposit	id	1,68	0,04	98,28	id	crystalloid deposit (less than in air)	id
12(A)	id	id	id	-			id 2 black spots	n	id
15(B)	id	more crystals	id	0,28	5,37	90,31	id	id	id
18(A)	white in the middle	id	r	O <sub>2</sub> scavenger (8,5 l)		100	id	id	n
22(B)	id	id (shrunk)	id	0	1,59	98,41	darker on the right	id (shrunk)	-
26(A)	more white	more crystals	id	-			id	id	id
29(B)	completely white	more crystals	more r	-			id	id	id
32(A)	id	id penetrate the cardboard	id	0,28	1,49	98,23	id	id	id
36(B)	id	id	id	-			white on the side	id	id
40(A)	id	id	id	-			id	id	id
43(B)	id	id	id	-			id	penetrate the cardboard	id
46(A)	id	id	id	O <sub>2</sub> scavenger (8,5 l)		100	id	id	r
50(B)	id	id	id	-			id	id	-
55(A)	grey spot on top	id	id	-			id	id	i
61(B)	id	id	id	-			id	id	r (less than in air)

n = normal	
id = idem	
r = rancid	
- = no measurement	

Fig. 47 Course of the development of the colour, structure and odour of the fat

Furthermore, the degree of the oxidative rancidity of the butter in an open and closed cardboard was measured at day 61 by determining the peroxide value (POV). The butter in the open cardboard (3.1 meq O<sub>2</sub>/kg in 100% N<sub>2</sub> and 13.8 meq O<sub>2</sub>/kg in normal air conditions) was more rancid than the one in the closed cardboard (0.7 meq O<sub>2</sub>/kg in 100% N<sub>2</sub> and 0.6 meq O<sub>2</sub>/kg in normal air conditions). Despite the leak in the MAP box, occurred during the first 36 days, the POV determination demonstrated that lipid oxidation in MAP was reduced. Furthermore, the differences in POV between open and closed cardboards demonstrated that protecting the butter from light, by placing it into a closed cardboard also reduced the lipid oxidation. Excluding oxygen, by applying MAP, clearly slowed down degradation on all the materials included.

The artwork *Butter and Beeswax* showed degradation processes, linked to each specific material and the combination of them. After accelerated ageing (62 days) the butter and fat impregnated cardboard used to produce the test samples showed various degradation processes due to oxidation. Without the application of any preservation technique, the rancidity process of the butter and the fat impregnated cardboard would increase, resulting in a loss of that part of the artwork (Figure 46). Applying MAP, excluding oxygen, could be a valid solution for the butter and the fat impregnated cardboard. For the preservation of the beeswax plates, physical degradation should be considered. Furthermore, a stable storage environment maintaining a RH = 60-70%, a maximum temperature of 16°C and light kept at its minimum, will be necessary in order to maintain the artwork.

### 6.3. Peter De Cupere: Eggs (1997, S.M.A.K.)

#### 6.3.1. Creating context for conservation

The Belgian artist Peter De Cupere (1970) dedicates his work to the exploration of the aesthetical potential of odours. His aim is to convince the audience that smelling certain odours can give a genuine aesthetic experience, because it works directly on memories and emotions. According to De Cupere, smelling is a very intuitive and associative act and hidden therein is the potential power of odour as an artistic medium. For him, the materials he used to create odours (varying from essences used in the composition of perfumes to aromas used in food) evoke forgotten memories or generate unexpected experiences (Renders 2006). Remembrance of childhood experiences, having to do with food and eating, are for De Cupere always connected with the memory of taste and smell. This is one of the reasons why he often experimented with the use of food materials in his art.



Fig. 48 Peter De Cupere: *First egg painting*, 1998, collection of the artist

De Cupere made several artworks containing raw eggs, painted egg scales or eggs that had been dried and removed from their shells. For his *First Egg Painting* (1998) (Figure 48), he used eggs, which he soaked in vinegar combined with an anti-mould product until the egg scales were dissolved (after 2 or 3 days). His 'egg paintings' formally recall the work of Marcel Broodthaers, but whereas Broodthaers used empty shells of eggs and mussels, as archetypal objects of his region, De Cupere strived to reinvigorate

his objects with new life. De Cupere connected his egg works with the aspects of life and death. In all of them, the smell of a breaking egg is suggested with the accompanying sulphurous smell (Van den Bergh 1999, Renders 2006). In addition, the artist is especially interested in the metamorphosis of the materials and in the different stages of their transformation, reminding Beuys' use of food (De Cupere 2000). But unlike Beuys, De Cupere his work did not specifically had to change physically. It was especially the idea of change that was needed, in order to let the artwork *Eggs* (Figure 49) function. The artist's touch, referring to his production process, is visible in all his egg works. This suggests that his materials cannot be interchanged just like that, which was confirmed by the artist during conversations about his work *Eggs* (De Cupere 2000).



Fig. 49 Peter De Cupere: *Eggs*, 1997, S.M.A.K.

The artwork *Eggs* contain 23 raw eggs, surrounded with baked chicken skin sewed to each other, laid in a metal egg basket. With this specific work, De Cupere was suggesting the presence of the sulphurous smell, but somehow the artist hoped that the eggs would never break. To evoke the sensory perception of a breaking egg, De Cupere tried to visualise the physical degradation of the surrounding chicken skin. According to Huys (2000), head of conservation at S.M.A.K. at that time, degradation processes visible on the baked chicken skin were allowed. After personal communication, De

Cupere confirmed that the skin was allowed to crack, the threads to lose strength and the fat in the skin to become rancid (De Cupere 2000). These statements underline that the changing form and transformation of his work is included here.

Thus, the impact of deterioration in this work is of importance at the visual, pictorial and semantic level. In order to preserve the original decaying materials as long as possible, measures to stabilize the work could be taken in the storage area.

### 6.3.2. Deterioration processes and condition of the different parts of the work: raw eggs, baked chicken skin, threads and metal basket

Materials	deterioration	remarks
raw eggs	some eggs are broken = physical degradation	
baked chicken skin	skin releases from the eggs cracking of the skin	after the baking process the skin became dry, because of fat crystallization the skin became brittle due to lipid oxidation (fat)
threads	-	
metal basket	-	

Fig. 50 Deterioration processes observed on *Eggs*

The artwork *Eggs* had suffered some decay since its acquisition in 1997: some of the eggs were broken and the chicken skin, which was dried out, was detached on some places from each other and from the eggs (Figure 50). The artist Peter De Cupere agreed to replace the broken eggs by new ones and, he gave the museum a clear description about the production process (De Cupere 2000, Huys 2000).

To determine the sensitivity of the food products to degradation, the generic intrinsic parameters such as the acidity value (pH, being the  $-\log$  (proton concentration) and the water activity ( $a_w$ ) of raw eggs, enabled to predict to some extent their vulnerability to the variety of degradation mechanisms, especially considering microbiological spoilage (Devlieghere et al. 2011).

Before starting the tests on the test samples, values of pH and  $a_w$  of liquid eggs similar as those used for the experiment were measured. The pH was 6,86 (measured by a pH electrode: Knick pH meter, Berlin, Germany). The  $a_w$  was 0,99 (measured with a cryometer: Typ AWK-20 (NAGY messsysteme GmbH, Gaufelden, Germany)). Thus, it can be concluded that the interior part of eggs are likely to spoil microbiologically, especially because the shell is permeable to microorganisms. The presence of various antimicrobial components in the egg white (e.g. lysozyme, which is also used as a preservative in for instance cheese) will slow down microbial growth, but nevertheless after sufficient amount of time, microorganisms will reach the egg yolk. This will finally result in the production of hydrogen sulphide, a process known as egg rotting (Yuceer et al. 2014). The pH of the baked chicken skin was 6,34 and the  $a_w$  was 0,97. The reduced  $a_w$  will make the product less sensitive to microbial growth, mainly for some bacteria type (Devlieghere et al. 2011).

Obviously, the eggshell is prone to physical degradation (e.g. broken eggs in the artwork), but also to moulding. Moulds can grow on the shell when the relative humidity of the surrounding air is sufficiently high ( $RH > 50$ ). Upon infestation of the shell, the moulds mycelium will penetrate within the egg white, causing so called mould rot, which is manifested by gelation of the egg white (also known as jelly production) (Devlieghere et al. 2011).

To produce the test samples, chickens with their skin were pan-fried using a significant amount of butter (fat) and spicy herbs until it was ready to eat (following the production method of the artist, De Cupere 2000). The baked chicken skins were separated from their carcasses and then stitched around the raw eggs. The fat crystallized upon cooling (Mellema 2003). The appearance of the fried and stitched skin became firm because of fat crystallisation. The skin lost water during the frying process and the fat was absorbed. Therefore the  $a_w$  value was reduced. As a result of the heat applied, the microorganisms present on the raw skin were also inactivated. However, because of moisture uptake and because of microbiological contamination from the environment during storage of the test samples, the skin can be considered to be microbiologically unstable and is most likely prone to moulding, due to the low  $a_w$  (Mellema 2003, Blumenthal 1991, Dobarganas et al. 2000). The fat, absorbed by the skin and originally present in the skin, is prone to oxidation, a process causing rancid offending odours (Blumenthal 1991). Moreover, in the presence of protein (chicken skin), lipid oxidation will result in browning and in changes of the physical texture of the protein tissue, explaining the



increased brittleness of the skin (Devlieghere et al. 2011). All these factors gave rise to a lower flexibility of the skin.

Furthermore, at the moment of stitching the threads absorbed also melted fat. The threads became hard after the fat solidified. Due to the loss in physical integrity of the skin, the threads cut through the skin and caused release of the skin from the eggs.

The metal basket was the most stable material, but could undergo corrosion after some years. This process is especially stimulated by a high relative humidity of the surrounding air.

### 6.3.3. Conservation by S.M.A.K.

The work *Eggs* was not exhibited during the last 12 years and thus did not suffer from fluctuating environmental conditions (T, RH and light) during its storage. During the storage period, the eggs were taken were separately wrapped into ethafoam and kept in a cardboard box. This box together with the egg basket were stored in an air-conditioned storage area with environmental conditions of 55% RH, 18°C and light intensity is kept at its minimum, as this room is accommodated with light timers and dimmers.

### 6.3.4. Proposition for preservation and experimental study: Modified Atmosphere Packaging (MAP): 50% N<sub>2</sub> and 50 % CO<sub>2</sub> and irradiation

For the work *Eggs*, storage in MAP (50% N<sub>2</sub> and 50%CO<sub>2</sub>) conditions and irradiation could offer a solution, to prolong the lifetime of the artwork and, could protect the food against degradation (Figure 53). Irradiation will protect the eggs against microbial degradation. Also, the work should be protected against O<sub>2</sub>, which stimulates the growth of bacteria and moulds.

During the experiment, N<sub>2</sub> was used in MAP to displace O<sub>2</sub> to delay oxidation, retarding the growth of aerobic spoilage organisms and performing as a filler to maintain package conformity. Ideally, the lower the storage temperature and the lower the losses of CO<sub>2</sub> and water are, the lower the quality loss during the storage of the eggs. Therefore, cold storage is important for egg preservation. A temperature of 0 to -1,5 °C and RH of 85-90 % are generally used. For the chicken skin, the temperature should not exceed 7°C and RH > 95%. For the threads, a

temperature of 16-20°C and RH 48-55% are indicated. Two test samples were irradiated in order to increase the growth of moulds and yeasts on the eggs.

The biggest problem for this case was the combination of food products and the threads. As the ideal temperature and RH values do not correspond for the different materials, it is valuable for conservators to strive for a stable environment and maintain a RH = 60-70% and a maximum temperature of 16°C. Light should be excluded as much as possible. This kind of preventive storage will also be helpful to slow down the degradation of the metal basket.

### 6.3.5. Results and discussion

Raw eggs, threads and baked chicken skin used by the artist to produce the artwork *Eggs* showed signs of degradation after 4 years, linked to each specific material and the combination of them. After accelerated ageing (49 days), only the baked chicken skin showed various degradation processes that could be evaluated. In order to evaluate the degradation processes, by the determination of POV and microbial counts, both destructive methods, the samples were given up.

#### 6.3.5.1 Preliminary experiment



Fig. 51 Mould growth on test sample *Eggs* (preliminary experiment)

In a preliminary experiment, two days after the chicken was baked, mould growth was noticed on the baked chicken skin (Figure 51). Therefore, the baking process was redone before the test samples were packed in MAP and/or irradiated.

The mould growth noticed during this preliminary experiment was most probably attributable to the too short duration of the baking process. Apparently, there was a difference in baking time between the production of the test samples and the original artwork. Because the artist did not remember the exact baking time, it was difficult to create a similar replica (De Cupere 2000). The chicken skin of the test sample was not dry enough and consequently the  $a_w$  value did not reduce sufficiently. Because of

moisture uptake and because of microbiological contamination from the environment, the skin became microbiologically unstable and moulding started (Devlieghere et al. 2011).

After a second longer baking process no mould growth was noticed. Thus, the chicken skin was dry enough resulting in an  $a_w$  reduction to 0,97, whereby mould growth could be avoided, before the samples were packed in MAP and/or irradiated.

### 6.3.5.2 *Visual and sensory decay*

During the course of the experiment, some changes were noticed in the structure and colour of the chicken skin during the ageing simulation. The other materials (threads, raw eggs and metal basket) did not show any signs of degradation, during the 49 days of the experiment. No mould formation could be seen either.

The chicken skin showed discolouration and loss of physical integrity, which were partially observed during the baking process, before accelerated ageing started. During the accelerated ageing, the chicken skin of the non-irradiated samples packed in normal air conditions and those in MAP became tarnished after 10 days. The skin of the irradiated samples did not. Furthermore, in all the samples the fat on the baked skin crystallized each time when stored in climate chamber B (6°C) and melted again in chamber A (30°C).

After 49 days the experiment was ended. The packages were opened and the peroxide value (POV) on the lipid of the chicken skin samples was determined. The POV determination showed that the non-irradiated baked chicken skin in MAP (2.7 meq O<sub>2</sub>/kg) was less prone to rancidity than the one in normal air conditions (64.8 meq O<sub>2</sub>/kg). The irradiated baked chicken skin had a POV that was higher than the non-irradiated, both in normal air conditions (119,6 meq O<sub>2</sub>/kg) and in MAP conditions (11,4 meq O<sub>2</sub>/kg). As irradiation is known to induce lipid oxidation (Du et al. 2001, Devlieghere et al. 2011), it was no surprise that POV increased on the irradiated samples. Clearly, excluding O<sub>2</sub> by applying MAP, resulted in lower POV for both the irradiated as non-irradiated skin, thus reducing the lipid oxidation.

### 6.3.5.3 Microbial counts

Microbial counts in the baked chicken skin were determined after the 49 days of the experiment. They were still under the detection limit, which explain no decay was noticed under daylight on the chicken skin during and after the experiment. Microbial counts in the raw eggs were not evaluated, because most certainly those would be lower than those in the chicken skin. The microbial counts in the chicken skin could be used as an indicator for expected degradation (Devlieghere et al. 2011).

		Non Irradiated		Irradiated	
Air (21% O <sub>2</sub> / 0,03 % CO <sub>2</sub> / 78,97 N <sub>2</sub> )	LAB	7,8 x 10 <sup>5</sup> /g	5,0 x 10 <sup>5</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	TPC	6,4 x 10 <sup>7</sup> /g	6,4 x 10 <sup>7</sup> /g	2,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	Moulds	1,0 x 10 <sup>2</sup> /g	1,5 x 10 <sup>3</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	Yeasts	2,3 x 10 <sup>3</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
MAP (50 % CO <sub>2</sub> / 50% N <sub>2</sub> )	LAB		6,6 x 10 <sup>5</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	TPC		4,0 x 10 <sup>7</sup> /g	2,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	Moulds		4,6 x 10 <sup>3</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
	Yeasts		3,5 x 10 <sup>3</sup> /g	<1,0 x 10 <sup>2</sup> /g	<1,0 x 10 <sup>2</sup> /g
Time /d		0	49	0	49
LAB = lactic acid bacteria					
TPC = total aerobic psychotropic count					

Fig. 52 Determination of microbial counts of the baked chicken skin, test samples Eggs

Depending on the conditions, in which the test samples were packed and, whether or not, they were irradiated, there were differences noticed in microbial counts on the chicken skin (Figure 52).

TPC in the samples in MAP conditions did not noticeably decreased (4,0 x 10<sup>7</sup> /g) after 49 days. The irradiated samples in MAP conditions decreased in TPC (2,0 x 10<sup>2</sup> /g) immediately after irradiation. Similarly, TPC in the samples not packed in MAP conditions decreased (2,0 x 10<sup>2</sup> /g) immediately after irradiation (time 0) compared to the non-irradiated samples (6,4 x 10<sup>7</sup> /g). After 49 days TPC of the irradiated samples in both conditions continued to decrease (< 1,0 x 10<sup>2</sup>/g). TPC of the non-irradiated samples remained the same after 49 days.

LAB decreased ( $< 1,0 \times 10^2$  /g) in both conditions immediately after irradiation (time 0) compared to the non-irradiated samples ( $7,8 \times 10^5$  /g). The non-irradiated samples showed a reduction in LAB both in air conditions ( $5,0 \times 10^5$  /g) as in MAP ( $6,6 \times 10^5$  /g).

Moulds and yeasts were also counted after 49 days of the experiment. Moulds ( $4,6 \times 10^3$  /g) and yeasts ( $3,5 \times 10^3$  /g) counts showed an increase on all non-irradiated samples. Immediately after irradiation mould and yeast counts both decreased after 49 days (both  $< 1,0 \times 10^2$  /g).

Both, irradiation as MAP, had a positive effect in order to preserve a food-based artwork, like *Eggs*. All samples showed reduction in microbial counts and LAB. Furthermore, irradiation had a positive effect on the growth of moulds and yeasts.

Materials	deterioration	preservation	remarks
raw eggs	physical degradation  microbial growth (bacteria and yeasts)  mould growth	Irradiation and / or  MAP, excluding oxygen	only possible in specialized centres  sterilization is needed loses sterility when taken out of containment  special equipment is necessary  adding absorbers and/or scavengers will help to maintain optimal gas environment  repackaging after exhibition
baked chicken skin	microbial growth (bacteria and yeasts)  mould growth  rancidity  brittleness of the skin	Irradiation combined with  MAP, excluding oxygen	dem above  irradiation will increase lipid oxidation
threads	threads will become hard due to the combination with the baked chicken skin: the threads absorbed the melted fat, which solidified.  Lipid oxidation (fat)	MAP, excluding oxygen	
metal basket	corrosion (oxidation)	MAP, excluding oxygen	

Fig. 53 Overview of degradation processes and preservation possibilities for *Eggs*

After the accelerated ageing, during 49 days, degradation processes were not detected on the raw eggs, threads and metal basket used to produce test samples of the artwork, even though deterioration processes in those materials will occur without applying preservation techniques when stored over a prolonged period (Figure 53). More specifically, oxidation processes, such as corrosion on the metal basket and lipid oxidation on the threads, have to be considered for the preservation of this food-based artwork. Applying MAP, excluding oxygen, could prevent those oxidation processes. Next to the application of MAP, a stable storage environment maintaining a RH = 60-70%, a maximum temperature of 16°C and light kept at its minimum, will be necessary in order to maintain the artwork.

#### 6.4. Zoe Leonard: *Strange Fruit (for David) (1993-1998, Philadelphia Museum of Art)*

##### 6.4.1. Creating context for conservation

As a lesbian artist Zoe Leonard (1961) struggled for freedom and the recognition of 'marginal' groups. Social issues, such as healthcare, gay rights, women's rights and AIDS affected her life and work. Leonard was involved in the ACT-UP Movement (The Aids Coalition to Unleash Power), which fought the intolerance and indifference of the American government and society in the face of the AIDS threat. Her artworks were more than often connected with political activism and more than often include a sensitive tonality of poetic fiction (Riemschneider & Grosenick ed. 1999).

In a lot of her works, she used found objects as relics dealing with history. She used those relics because of her interest in marks and things left behind, like archaeological findings that are recollected in order to examine and understand the world (Dungan 2002). She often connected her work with themes, such as disappearance and absence, and worked with the idea of reconstructed experiences based on: memory, the desire to remember and the changeable quality of memories (Temkin 1999, Dungan 2002). Zoe Leonard described her work in *An Interview with Zoe Leonard* (Dungan 2002): *I'm interested in the power objects hold for us. We rely on them to represent ideas, philosophies, beliefs and memories. We have an innate need to look at, and to look for, symbols. They give us a way to focus. I think that is why I work with both photography and sculptures. In both mediums, my practice is remarkably similar. I work with found objects and images, things I notice. Either I take a picture or I collect the objects and*

*arrange them: re-present them, re-frame them. As an artist I try to invest my work with meaning. I keep working until the piece seems to embody its own idea, so that the intention and the material become inseparable. I want the work to be able to speak on its own.*



Fig. 54 Zoë Leonard: *Strange Fruit (for David)*, 1993-1998, Philadelphia Museum of art

Much of Leonard's work deals with the passage of time and the inevitable change. This was especially the case for the floor installation *Strange Fruit (for David)* (1993-1998) (Figure 54). Although, this was the only piece in which she used food, it exemplifies her activism on behalf of feminism, gay rights and AIDS. *Strange Fruit* includes 200 pieces of fruit peels sewed back together with zippers, wires, thread and buttons. It took Leonard from 1993 to 1997 to realize the work. After eating the meat of the fruit, the artist let the skins dry out and then 'repaired' them. She developed a story for the piece, discussing its evolution as a work of mourning after the death of a friend. For her, it was a way to 'sew her self back up', without consciously realizing she was making art. Her claim that she didn't realize she was creating art, typifies the rhetoric of the strain of 20<sup>th</sup> century art that has sought to erase the boundaries between art and daily life (Temkin 1999).

The individual fruit peels that make up Leonard's *Strange Fruit (for David)* were displayed scattered across the floor. Leonard's decision to use perishable materials suggests different connections. The fact that these objects were once pieces of fruit, and the process that transformed their character without altering their essential organic nature, adds an abundance of specific associations. The title refers to Billie Holiday's song about lynching, to Leonard's friend David Wojnarowicz (also an artist), who died of AIDS in 1992 and to the pejorative term of fruit as slang for gay (Dungan 2002). The song went as follows: *Southern trees bear a strange fruit . . .strange fruit hanging from the poplar trees . . . Pastoral scene of the gallant South . . .Here is a fruit for the crows to pluck, For the rain to gather, for the wind to suck, For the sun to rot, for trees to drop, Here is a strange and bitter crop* (Dungan 2002).

The first time *Strange Fruit (For David)* was exhibited in her apartment in 1995. In 1997, it was shown at the Museum of Contemporary Art in Miami and at the Kunsthalle in Basel. In 1998, when curator Ann Temkin expressed interest in acquiring this piece of art for the Philadelphia Museum of Art, Zoe Leonard considered employing preservation methods.

Leonard did not expect her sculpture to end up in a museum and, she was amenable to devise a way to stop the decay of the fruit surfaces. Early on, her dealer Paula Cooper suggested the possibility of preservation. Afterwards, she worked for two years with conservator Christian Scheidemann (see part I). After much testing, Scheidemann developed a solution that consisted of shock-freezing the pieces and then soaking them under vacuum with the consolidant Paraloid B72. In the end, the artist opposed to this preservation strategy, feeling that the ongoing process of decay was part of the installation. But, a part of the fruit peels were preserved by this method and according to Leonard those could serve as documentation of the original artwork. In the interview with Beth Dungan (Dungan 2002) she said:

*For me, preserving the object is like preserving the experience, the memory, or the set of associations. Strange Fruit deals with the conflict between hanging on and letting go. The conflict in that piece is that every scrap is saved, painstakingly mended, but since the peels are not preserved, they continue to decay. Over time, the shrivel fade. The piece is slowly disintegrating.*

Ann Temkin (1999) argued her decision of rejection of its preservation, as a reaction determined by art history, referring to the decaying works of Joseph Beuys and Dieter Roth (see part 1). If she would preserve the



whole piece, by applying Scheidemann his treatment, the pretence of deterioration was no longer persuasive.

#### 6.4.2. Deterioration processes and condition of the different parts of the work: fruit peels and threads

The artwork *Strange Fruit* by Zoe Leonard was still in a good shape, since its acquisition in 1998, by the Philadelphia Museum of Art, maintaining an acceptable colour and structure of the adapted fruit peels, because of the work's limited display.

Generally, the fruit peels, such as banana peel, different kinds of citrus fruit peels (lemon, orange, mandarin and grapefruit) and avocado peels, used by Zoe Leonard protect the whole fruits. Banana peels are useful as insecticide, colour absorber and antioxidant (Debadandya et al. 2010). Avocado peels have a high amount of phenolics and an intensive in vitro antioxidant potential. Avocado materials have moderate antimicrobial effects against gram-positive bacteria. Especially, the peels are known as inhibitors of oxidative reactions (Rodriguez-Carpena et al. 2011). Citrus fruit peels are also known as having a high phenolic content. Phenolic compounds are important for their sensory qualities that impart the colours of many plants. They have the ability to function as antioxidants (Li et al. 2006, Guo et al. 2003) and Ghasemi et al. 2009).

To produce the test samples, fruit peels of bananas and mandarins were used. The fruit contents were removed from their skin, while after they were remodelled. The mandarin peels were stitched together with polyester threads. The banana peels were provided with metal zippers, stitched with similar threads.

To determine the sensitivity of the food, used for the samples, to degradation it was required to know what the sensitivity of the fruit peels are to microbial, chemical and enzymatic reactions. Following the generic intrinsic parameters, such as the acidity value (pH, being the  $-\log$  (proton concentration) and the water activity ( $a_w$ ), it was possible to predict to some extent their vulnerability to the variety of degradation mechanisms (Devlieghere et al. 2011).

Before starting the tests on the test samples, values of pH and  $a_w$  of mandarin and banana peels were measured. Naturally most fruits are high acid food (pH below 4,6) (Fraser 1998). The banana peel used for the test samples had a pH of 5,86 (at 21°C, measured by a pH electrode: Knick pH meter, Berlin, Germany), while  $a_w$  was 0,936 (at 25°C, measured

with a cryometer: Typ AWK-20 (NAGY messsysteme GmbH, Gaufelden, Germany). The mandarin peel had a pH in between 4,6 and 5,2 (at 21°C), while  $a_w$  was 0,942 (at 25°C). Thus, it can be concluded that the fruit peels have a lower acidity than whole fruits (Jacxsens 2002). Because of that, and because of their high  $a_w$ , the fruit peels, used in this experiment, are liable to the development of lactic acid bacteria, yeasts and moulds (Devlieghere et al. 2011). Furthermore, at the moment of stitching the threads cut through the peels and cause loss in physical integrity of the peels. Due to the loss in physical integrity, the threads could cause release of the peels. Here, the banana peel was combined with a metal zipper, which can corrode.

Because of moisture uptake, and because of microbiological contamination from the environment, during storage, the peels can be considered to be microbiologically unstable and are mostly likely prone to moulding due to an increase in  $a_w$  (Devlieghere et al. 2011). Also, high temperatures ( $> 10$  °C) have an influence on the colour of bananas because of the ripening process (become black), which furthermore has an influence on their physical integrity (Chen and Ramaswamy 2002).

#### 6.4.3. Conservation by the Philadelphia Museum of Art

When the board of the Philadelphia Museum of Art decided to buy *Strange Fruit*, curators were less sure about acquiring it, because of their uncertainty concerning the conservation of works consisting such perishable materials. Nevertheless, the museum acquired the piece and agreed to store it properly when not on show. Interesting was the discomfort some had in assigning it an acquisition number, since how can you give a number to something that will disappear? Curator Ann Temkin argued that the assignment of a number does not guarantee forever and a museum is dedicated to preserve more than individual works of art that are fixed and immortal (Temkin 1999).

Leonard permitted to photograph successive installations of the piece slowly deteriorating over time. Thus the process of deterioration was documented and, Leonard explained they could interpret the pictures as an ongoing, diary-like project. The description of the preserved objects, as photographs, is significant, as Leonard her work often involved many different forms of photography, which she connects to the process of memory. Furthermore, museum professionals agreed to collaborate with the artist on a long-term basis to determine when the piece was no longer presentable and, what should be done with it at that specific time.

Since its acquisition, it was shown several times by displaying as Leonard did, scattered on the floor. The work continued to decay as intended by the artist. However, as it is mainly in storage it stayed in pretty good shape. For the storage, museum professionals at the Philadelphia Museum of Art agreed to use optimal storage conditions in order to retard the degradation of the work (Buskirk 2000).

Also, a few similar, smaller works still exist. These were made up of several pieces of sewn fruit shown on shelves or a table. One is in a private collection in Italy, one is owned by Galerie Gisela Capitain, and one is in the collection of the Baltimore Art Museum. As long as Leonard's fruits were properly stored they remained in a presentable condition (mail Paula Cooper Gallery).

#### 6.4.4. Proposition for preservation and experimental study: Modified Atmosphere Packaging (MAP): 100% N<sub>2</sub>

Materials	deterioration	preservation	remarks
Fruit peels	Microbiological degradation (moulds and bacteria) Physical degradation and physiological degradation (wounded tissue of peeled fruit)	MAP, excluding oxygen	special equipment is necessary adding absorbers and/or scavengers will help to maintain optimal gas environment repackaging after exhibition
Polyester threads	-	MAP, excluding oxygen	Same as above
Metal zipper	corrosion (oxidation)	MAP, excluding oxygen	Same as above

Fig. 55 Overview of degradation processes and preservation possibilities for *Strange Fruit*

The case *Strange Fruit (for David)* by Zoe Leonard was chosen, as it could benefit from the results of an ongoing PhD study at Ghent University, concerning the respiration rate of fruits and vegetables, under Equilibrium Modified Atmosphere Packaging (EMAP) (Jacxsens et al. 2004). Contrary to the other food (raw eggs, fat and baked chicken skin) examined in the other cases, fruits normally have to be packaged in an atmosphere that includes O<sub>2</sub>. However, partial results of this study showed that the respiration behaviour of fruits was not coming from the peels, but from the fruit pulp, so finally, EMAP did not seem the right preservation

technique. However, storage in MAP (100% N<sub>2</sub>) conditions could offer a solution in prolonging the lifetime of the artwork and in protecting the fruit peels against degradation (Figure 55).

The work should be protected against O<sub>2</sub>, which stimulates the growth of bacteria and moulds. During the experiment, N<sub>2</sub> was used in MAP to displace O<sub>2</sub> to delay oxidation, retard the growth of aerobic spoilage organisms and to act also as filler to maintain package conformity. To avoid the release of moist as much as possible, conservators should strive for a stable temperature (4-7 °C) and RH (60-70 %). For the threads a temperature of 16-20°C and RH 48-55% are indicated.

The biggest problem for this case was the combination of fruit peels and the threads. As the ideal temperature and RH values do not correspond for all the different materials, it is valuable for conservators to strive for a stable environment and maintain a RH = 60-70% and a maximum temperature of 16°C. Light should be excluded as much as possible.

#### 6.4.5. Results and discussion: visual and sensory decay

Mandarin and banana peels, used by the artist to produce the artwork *Strange Fruit*, both, showed degradation processes linked to each specific material and, the combination of them.

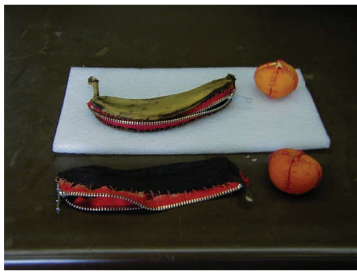


Fig. 56 Shriveled mandarin peels (test samples)



Fig. 57 Mould growth on banana peel (reference sample)

The mandarin peel, from both test samples, dried out after day 4 in both conditions, but the reference sample (air conditions) seemed more shriveled (Figure 56- 57). The colour of the reference sample was darker than the sample stored in MAP conditions.

Time/ d (Clime)	Colour	Structure	Moulds
0(/)	normal	normal	no
4(A)	black spots, black where zipper hits banana	wizened	no
8(B)	completely black	idem dried out	no
11(A)	idem	seems moist	white
14(B)	idem	shrivelled	idem
22(B)	idem	idem	more
25(A)	idem	idem	more
28(B)	idem	idem	white and greenish
43(A)	idem	idem	idem

Fig. 58 Evolution of colour, structure and moulds observed on the banana peel in air conditions (reference sample).

No decay was noticed on the banana peel in MAP conditions. The evolution of colour, structure and mould development of the banana peel of the reference case was tabulated (Figure 58). In contrast to the MAP-stored banana peels, the banana peels of the reference case showed visible mould growth after 11 days (Figure 57), which gave further rise to the discolouration of the product after 28 days, due to mould sporulation.

After accelerated ageing (49 days), it was clear that applying MAP, excluding oxygen, could inhibit the degradation processes. Next to the application of the food preservation technique MAP, a stable storage environment maintaining a RH = 60-70%, a maximum temperature of 16°C and light kept at its minimum, will be necessary in order to maintain the artwork.



## Chapter 7: Museum research and the role of food preservation science: 4 case studies

Parts of this chapter are published in:

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Gilman J. (2011): Envers une stratégie de conservation pour oeuvres éphémères: entre le matériel et le conceptuel, Cultural Heritage/Cultural Identity - The role of conservation – *preprints of the 16th Triennial ICOM-CC Conference*, Lisbon.

### 7.1. Museum practices, problems and potential solutions for the presentation and conservation of food-based art: 2 theoretical case studies

#### 7.1.1. René Heyvaert: *Untitled* (1982, M HKA)

##### 7.1.1.1 Creating context for conservation

The Belgian artist René Heyvaert (1929-1984) worked with drawings, photographs and mail art, but was especially known for his work with found objects. He had a preference for the most ordinary everyday life materials. Heyvaert took mundane objects out of their context, stripped them of their function and gave them, with a minimal intervention, new meanings by bringing them into the museum. His works were minimalist and reminiscent of daily uses (Dockx et al. 2006). A lot of his works bear references to household objects and food: cutlery joined together, different knife objects, a split spoon and a curved fork. For his *Bambix*, *Brinta* and *Kitekat boxes* (1981-1983) (Figures 59-61), Heyvaert glued the empty boxes of cereals on a wooden board and stapled cans of cat food fixed in the form of a cross. This use of 'ready-made' material, in which the repetition of elements were part of a larger pattern were an

unmistakable reference to pop art (Laporte and Mast 2006). Heyvaert's objects, which explicitly evoke a reaction to their viewer, responded to a concrete and personal need for meditation. This artist had a digestion and immunity disease. He became ill during his army duty in Congo in 1954 and was sent home for treatment of tuberculosis of the kidneys. According to Lieve Laporte (Richard Foncke Gallery, Ghent, Belgium), who was a close friend from Heyvaert and, who owns a great part of his oeuvre, his art making was a matter of survival and his only way out to battle his disease. Because eating was a hellish operation, so much that he could only consume baby food, his artworks objects were connected to food or implied food products (Laporte 2011).



Fig. 59 René Heyvaert: *Untitled*, (1982), Bambix boxes, private collection



Fig. 60 René Heyvaert: *Untitled*, 1981- (1982), Brinta boxes, private collection



Fig. 61 René Heyvaert: *Untitled*, 1982- (1983), Kitekat boxes, private collection

His artwork *Untitled* (1981) (Figure 62) was made of bread rolls fixed on two wooden sticks, which form a cross. The organic nature of the bread rolls contrasted very sharply with the rigidity of its geometry (the cross). In Heyvaert's work, the surroundings always played an important role that cannot to be disregarded. For Heyvaert, the functionality of his objects elevated the aesthetic experience to a higher level, as this was what his illness and the consequent limitations of his body taught him. Therefore, his art was the result of investigations on the corporeal and material possibilities of functional objects, which was also the case for *Untitled*. The original form was not the subject, but its unusual simplicity focused the attention on the material and reflected its position in life. His formal language was quite austere and modest, but always included a subversive element. The loaded meaning of the cross was simplified by forming it with daily bread (website M HKA). Furthermore, the tension arose out of the creative process between the idea and its execution (website S.M.A.K.).





Fig. 62 René Heyvaert: *Untitled*, 1981, bread cross, M UHKA.

In 2007, Lieve Laporte donated *Untitled* to the Museum of Contemporary art in Antwerp (M HKA), as the director of this museum wanted to extend their Heyvaert collection and, the bread cross was one of the significant works in his oeuvre. According to Laporte, this sculpture had to be remade each time it is exhibited and, as a consequence, the donation consisted of a replica she made in 2004. She remade the work based on the last version of the cross Heyvaert made in 1982, following Heyvaert's instructions, in order to procure the museum a visual idea of how the work should look like. Through different conversations with the artist, she was able to find out what Heyvaert intended to communicate with this work. Heyvaert explained her which breads to use, coming from a Ghent bakery Bloch, and he showed her how to attach the bread rolls to the wooden sticks (Laporte 2011). Furthermore, he defined how the work should look like during conversations with some other stakeholders: the artist's estate (his daughters) and Jan Mast (Belgian artist, who elaborated research on Heyvaert) (Laporte et al. 2006). Thus, in this case, the actual artwork is not a physical object, but a concept, owned by the M HKA.

#### 7.1.1.2 Deterioration processes of the food: bread rolls

To determine the sensitivity of food products towards degradation processes, it is required to gain insight which physical, microbial, chemical and/or enzymatic reactions can occur. As seen before, such reactions are very matrix dependent and, knowledge on food science comes into the decision-making processes for art conservation.

Parameters, such as the acidity value (pH) and the water activity ( $a_w$ ), can aid in assessing the vulnerability to this variety of degradation mechanisms. The pH value for bread lies in between 4 and 5 and the  $a_w$  value in between 0,90 and 0,95. These ranges of  $a_w$  and pH allow growth and proliferation of microorganisms (Devlieghere et al 2011). Bread rolls, such as those in the artwork, contain more crust on the surface. As bread crust is rather dry, it has a lower  $a_w$  and makes microbial growth impossible. During the baking process, the bread rolls become almost sterile. Thus, if they are directly after their production protected in a sterile and oxygen-free environment, microbiological proliferation will not occur and mould growth could be avoided. But, if the RH of the environment is high, the crust will absorb water, causing a rise in  $a_w$  and subsequently, mould growth (Devlieghere et al 2011).

Materials	deterioration	preservation	remarks
Bread rolls	physical degradation	MAP, excluding oxygen (100% N <sub>2</sub> ) Addition of salt in the protective case	special equipment is necessary
	microbial growth	Addition of natural preservatives (ginger, garlic, honey, clove, cinnamon) during production of the breads	adding absorbers and/or scavengers will help to maintain optimal gas environment
	mould growth		repackaging after exhibition
	external contamination (insects)	Addition of chemicals (ascorbid acid, polysorbate 60, lecithin, calcium propionate, sodium propionate, sodium bisulfite, sulphur dioxide) during production of the breads	addition of preservatives and chemicals changes the original production process of the breads
	oxidation		

Fig. 63 Overview of degradation processes and preservation possibilities for the bread rolls, *Untitled*

Furthermore, as the artwork is reproduced each time it has to be exhibited, it is also possible to rely on preservation possibilities when producing the bread rolls (Figure 63). Natural bread preservatives, such as ginger, garlic, honey, clove, and cinnamon could be used during the production. The addition of stabilizers will improve the bread rolls microbiological and chemical (Devlieghere et al. 2011). Adding certain chemicals can help to preserve the bread for weeks or even months after baking. For example, the addition of ascorbid acid (also known as vitamin C), lowers pH levels and stops the enzymatic process that makes bread go bad (Bauernfeind & Pinkert 1970). Furthermore, polysorbate 60, which is an emulsifier, prevents bread from getting stale (Langhans & Thalheimer 1971). The antioxidant lecithin stops oxidation and prevents bread from going rancid (Adler & Pomeranz 2006). Calcium propionate and sodium

propionate are two of the most common additives in bread, which main function is to prohibit mould growth (Guynot et al 2005). The preservatives sodium bisulfite and sulphur dioxide are additives that prevent bacterial growth and are most commonly used in food products that are going to be spending long amounts of time either exposed to the air, which is the case when the bread rolls are on display (Adams et al. 2004).

### 7.1.1.3 Conservation issues and museum practices

Following the instructions of the artist, Heyvaert's cross with bread was reconstructed each time when it was exposed (De Baere 2011). Because *Untitled* is easily reproducible, confusingly different documentation copies of the work are circulating today. The first 'original', with only a few bread rolls left over, was made in 1981 by the artist and is at Lieve Laporte's place in Ghent (Laporte 2011). One of the following copies is used as a reference document for reproduction and is currently at the depot of M HKA. Another copy from 1989 is at the depot of the S.M.A.K., where the work was on loan a few years ago for an exhibition (Bohez 2011).



Fig. 64 René Heyvaert: *Untitled*, 1981, bread cross in protective showcase, M UHKA

In the first exhibitions, a solo show in Galery Drieghe (1983, Wetteren, Belgium) and a group show *Pauvreté et Baroque : 6 artistes flamands contemporains : carte blanche à Jan Hoet : Installation 6* (1989, Musée des Beaux-Arts, Le Havre, France) the bread cross *Untitled* was presented as Heyvaert instructed. For these exhibitions, the cross was each time remade by Lieve Laporte with the bread rolls from the Bloch bakery in Ghent. She was then the owner of the work and knew how to produce the cross. During these shows, the cross was presented without a protective showcase (Figure 62) (Laporte 2011).

In one of the following exhibitions, *De Gustibus. Rond eten in de hedendaagse kunst* (Broelmuseum and ING Kortrijk 14/02-29/04 2004), the curator decided to present the artwork in a polyacrylate showcase (Figure 64), because he was afraid that the fragile bread rolls would be

damaged (Van Den Abeele & Van Durme 2007). For this show, Laporte made her last replica and delivered the work without a surrounding box (Laporte 2011).



Fig. 65 René Heyvaert: *Untitled*, 1981, production of the bread cross, M UHKA

After the donation to M HKA, the cross was each time presented in this protective showcase (Figure 63), such as during the show *Extra Muros: A story of the image. Old and New Masters from Antwerp National Museum of Singapore* (2009) and during the *Extra Muros: Meesterwerken in het MAS. Vijf eeuwen beeld in Antwerpen* (2011). Museum professionals working at M HKA reconstructed the work both times (Figure 65) (Lambrechts 2011). They devised a way to imitate the original look of the piece. They reproduced the work each time with resembling bread rolls and followed the instructions given by the artist. Christine Lambrechts

(conservator at M HKA) explained that they established a manual for themselves, which is based on the instructions of the artist's estate, Laporte's instructions and on the visual image of the replica made by Laporte in 2004. This replica is for the museum an important document and served as a reference each time the work was remade. The manual includes descriptions of size and form of the specific Belgian bread rolls, pictures of previous replicas and instructions on the application of the bread on the wooden sticks (Lambrechts 2011).

Because the Ghent bakery Bloch (where the artist bought his 'original' bread rolls in 1982) ceased to exist in 2008, the conservator of the M HKA made the work with resembling bread rolls coming from an old fashion bakery in Antwerp. The conservator applied the breads 'freshly' on the sticks before inserting the cross into the polyacrylate showcase (Lambrechts 2011).

During the Singapore show in 2009, webbing cloth moths (a museum pest) encountered in the work. 2 samples were provided for identification to Rentokil Intial PTE LTD, an expert in pest control. The identification report mentioned (Email communication between the M HKA and the Singapore museum, August 2009): *Clothes moth larvae feed on wool*,

*feathers, fur, hair, leather, lint, dust, paper, and occasionally cotton, linen, silk, and synthetic fibers. They have the ability to turn keratin, a protein present in hair and wool, into food. Clothing moths prefer dirty fabric and are particularly attracted to carpeting and clothing that contain human sweat or other liquids, which have been spilled onto them. They are attracted to these areas not for the food but for the moisture. Moth larvae do not drink water; consequently their food must contain moisture. They are destructive during the larvae stage. Adult moths are entirely harmless. Clothes moths rarely fly to lights at night and instead prefer darkness, such as a closet or storage chest. The adults are very active, can penetrate through surprisingly narrow cracks, and can fly considerable distances. Gravid females are weak fliers. Any clothes moths fluttering around the house are probably males, because females travel by running, hopping, or trying to hide in the folds of clothing. Female webbing clothes moths lay 40 to 50 eggs that hatch in 4 to 21 days. Larvae will wander some distance away from their food source to pupate in crevices. The pupa case is silken with bits of fiber and excrement attached to the outside. The life cycle is about 65 to 90 days.*

Probably the moth problem was due to the fact that in Singapore the RH is increasingly higher than in Western Europe. Because of that, most probably, the bread crust had absorbed moisture and  $a_w$  increased, which made the breads attractive for insects such as the moths (Devlieghere et al 2011). Although, mould growth didn't occur in this case, conservators should be aware of possible mould growth when  $a_w$  increases.

As the artwork was completely sealed with silicon in the protective showcase and, there was no possibility for the moths to escape at that moment, conservators monitored the activity of the moths. If the moths would have multiplied at an alarming rate or, if there would be a possibility for them to escape from the case, they would have removed the artwork to protect the other works displayed alongside it (Email communication between the M HKA and the Singapore museum, August 2009).

This case demonstrates that even for short-term exhibitions food based art needs protection, in order to maintain until the end of an exposition. Therefore, food preservation knowledge could offer conservators more possibilities to maintain such works.

### 7.1.1.4 Potential solution and the role of food preservation (Figure 66)

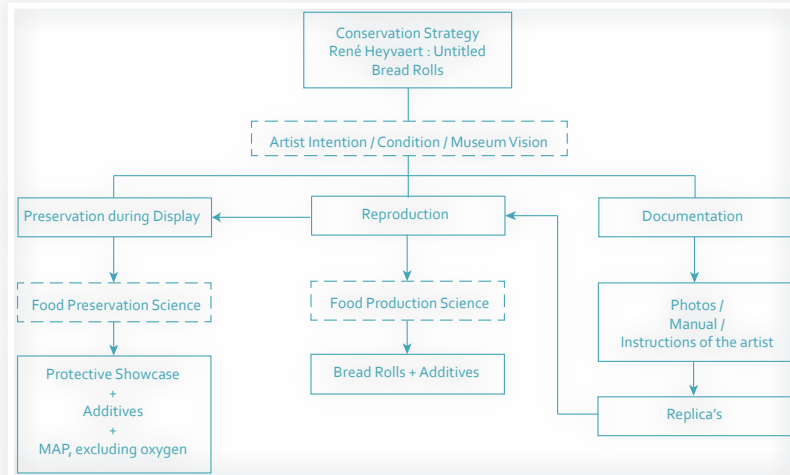


Fig. 66 Conservation strategy *Untitled* by René Heyvaert: bread rolls

Because, the work is remade for every exhibition, the question of short-term preservation restricted to occasional display raised. To suppress microbial growth, as well as to protect the bread rolls from external contamination (with for instance insects), a protective showcase can indeed prevent the deterioration of food. This deterioration results from their exposure to air, moisture, or pH changes associated with the food or the surrounding atmosphere (Cutter 2002). Presenting this work in MAP conditions could improve its preservation, as it could prolong the lifetime of the artwork while it is exhibited. The bread rolls could be protected against  $O_2$ , stimulating the growth of bacteria and moulds, by using  $N_2$  in MAP (to displace  $O_2$ ). This will slow down the growth of aerobic spoilage organisms and act as a filler to maintain package conformity. The polycarbonate showcase that M UHKA employed is ideal to use MAP.

Furthermore, adding salt into the box would stabilize the bread rolls. For instance, Sodium chloride (NaCl) has been used for the preservation of food. NaCl is a versatile compound that contributes to the functional properties of bread products (Samapundo et al 2010). Eventually, NaCl could be inserted on a scale in the basis of the cross-form case, in order to absorb the moisture of the surrounding atmosphere. RH will increase because of that and, consequently,  $a_w$  will increase. This will prevent moulds to grow and insects to be attracted by the bread (Guynot et al. 2005).

Increasing the  $a_w$  of the bread rolls could be obtained by changing the baking process of the bread. By adding more salt and/or sugar into

the dough, the  $a_w$  will also be reduced and prevent them from mould growth and attraction by insects. Fibre will absorb water, but has little influence on the  $a_w$ -value. As a result, products with reduced salt and/or sugar content (so called "light" products) will mould more readily, than products containing more salt and/or sugar (Guynot et al. 2005).

Also, the addition of stabilizers to improve the bread rolls microbiological and chemical could be discussed. Most preservatives avoid the development of microorganisms and use pH reduction for their anti-microbial properties. The pH will play a role in the development of moulds (Bauernfeind & Pinkert 1970). The pH of the product will be lower, when introducing 3 different types of preservatives. Mineral acids, such as phosphoric acid, are strong acids and have a great effect on the pH. Organic acids, such as lactic acid, tartaric acid or benzoic acid, have a smaller effect on the pH, but are better preservatives than mineral acids, because they really slow down the development of moulds. Fatty acids, such as acetic acid, sorbic acid and propionic acid, will influence the pH in a limited way, but they are very effective as anti-microbial agents. All these acids will slow down the development of moulds (Bauernfeind & Pinkert 1970, Langhans & Thalheimer 1971, Guynot et al. 2005).

The addition of sugar and/or, salt and/or, stabilizers is a more intensive preservation treatment. If these propositions can be substantiated, an interdisciplinary dialogue between a food scientist and the conservators is required, to outline a new production process. By using MA and/or, by adding sugar and/or, by adding salt into the protective case mould growth could be avoided. By combining such preservation techniques, it should be possible to maintain the breads during 90 days or more (Adams et al 2004).

Next to the use of these preservation techniques from the food industry, maintaining a stable environment is required. Temperature and moisture favour the development of moulds and bacteria (Devlieghe et al 2011).

Furthermore, gathering together the circulating replicas would be useful for the conservation of *Untitled*. Those replicas serve as references, in order to obtain the best remade. The replica preserved by M HKA in its storage, is the most complete document at this point in time, as in this replica all the bread rolls, although, some damaged (due to manipulation and transport) are still 'hanging' on the cross. Therefore, stable storage conditions ( $T = 16\text{ }^{\circ}\text{C}$ ,  $\text{RH} = 60\text{-}70\%$ , light kept at its minimum) should be maintained by M HKA, in order to preserve this important document.



### 7.1.2. Jason Rhoades: *P.I.G.* (1994, S.M.A.K.)

#### 7.1.2.1 Creating context for conservation



Fig.67 Jason Rhoades: *My Brother Brancusi*, 1995, courtesy of David Zwirner Gallery

The American artist Jason Rhoades (1965-2006) became famous in the 1980s and 1990s, mainly by combining a wide variety of objects in his installations, occupying whole rooms Rhoades created symbolically charged environments out of commercial and industrial products, such as fast food. This artist reacted to the thousands of impressions that people receive every day, by inserting self-made machines that manufactured French fries or donuts (Figure 67), machines that emitted smoke and often added tiny televisions, all producing a lot of noise (Ruyters 1998, Riemschneider & Grosenick 1999). Many elements in Rhoades' installations were the result of the conditions of the exhibitions, because he created his installations in situ and because of the influence of the people that were involved during this creation (Rhoades & Meyer-Hermann 1998).

As a result, his installations look extremely chaotic such as the work *Piece in Ghent (P.I.G.)* (1994, S.M.A.K.) (Figure 68). In this installation, he mixed objects and materials, referring to an element in *The Mystic Lamb* (Figure 69) by the Van Eyck brothers - hence the title *Piece in Ghent* referring to the Altarpiece in the St Bavo Cathedral in Ghent. For





Fig. 68 Jason Rhoades: *Piece in Ghent* (*P.I.G.*), 1994, S.M.A.K.



Fig. 69 Jason Rhoades: part of the installation *The Mystic Lamb, Piece in Ghent* (*P.I.G.*), 1994, S.M.A.K.

*P.I.G.* Rhoades connected Van Eyck's images to elements of his own life. He situated the painting in the modern world and used it to initiate a conversation with the environment. This installation is devoid of any recognition of Christian iconography and symbolism, which is the standard narrative of the Altarpiece (Galland 1994). The work is charged with the idea of a young American man approaching the famous Ghent Altarpiece, without knowing anything about the symbolism or religious significance. In accordance to this perspective, the symbols of the *The Mystic Lamb* were replaced by familiar objects from the American environment and thereby acquired new meanings (Rhoades & Meyer Hermann 1998). The Jacuzzi e.g. replaces the fountain, the just judges became motorcyclists and the production of the French fries referred to the sophisticated oil painting technique used by 15<sup>th</sup> century painters (Galland 1994). Aside from its materiality, the complex installation *P.I.G.* appeals thus to a lot of immaterial parameters for which conservation specialists have to develop new strategies for conservation. Indeed, many elements in Rhoades' installation originated from the specific condition of the location in which the work was created, the people that were involved, the place of the piece within the artist's oeuvre and his biography.

*P.I.G.* was created for the exhibition *This is the show and the show is many things* (17<sup>th</sup> of September until the 27<sup>th</sup> of November 1994), curated by Bart De Baere at the Museum voor Hedendaagse Kunst (MHK, Museum of contemporary art) in Ghent, Belgium. The exhibition was conceived with the idea of combining different artistic approaches and stimulating new joint ventures between artists. The artists involved planned the exhibition through workshops, defining relationships between each other and, they redefined the functions of the museum space. Many of the works were being adapted and changed by the participants while the show was running, which was also the case for Rhoades' piece (De Baere 2011).



Fig. 70 Jason Rhoades: *Piece in Ghent (P.I.G.) in process*, 18th September 1994, *This is the show and the show is many things*, Museum of Fine Arts (MSK), Ghent.

During the first month of the exhibition, this installation consisted of objects and materials that were spread on the floor (Figure 70) and, in which several performances took place: the artist drove the 'dirt' bike, he relaxed in the Jacuzzi and left towels on the floor, he 'fired' fries from a self-made weapon *A.B.S. GUN with Pom Fritz Choke and Aqua net*, which uses hairspray as a propellant to shoot potatoes (Figure 71). He then collected the sliced potatoes, fried them in oil in a *King kooker*, an outdoor cooker with aluminium frying pan (Figure 71) and served them as French fries. Afterwards, he collected all his 'stuff' and stacked all the objects and materials in a cage, consisting a wooden frame with wire netting (Figure 68). This cage enabled Rhoades to keep control over his creation and provided a formal analogy to the altarpiece itself, which is located behind a protective glass cage (Ruyters 1998, Rhoades & Meyer Hermann 1998). By re-installing *P.I.G.*, Rhoades re-evaluated his own artistic statement by distancing the viewer's perspective, and his own from understanding the religious world (Rhoades & Meyer Hermann 1998).



Fig. 71 Jason Rhoades: *A.B.S. GUN with Pom Fritz Choke and Aqua net*, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.

After this exhibition, the owner of the artwork, a Belgian collector offered it to S.M.A.K. as a long-term loan in exchange for its management. Subsequent displays of *P.I.G.* were from then installed within the cage, including original French fries (Figure 73-74 and fig. 77), three *Aqua net hairsprays* (Figure 75), five *ABS guns* (Figure 76) and five *King kookers* (Figure 72). It was



Fig. 72 Jason Rhoades: *King kooker* with frying pan, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.



Fig. 73 Jason Rhoades: original French fries, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.

installed in two collection exhibitions at S.M.A.K., *Gelijk het leven is* (2003), *Inside Installations* (2010-2011) and the exhibition *Y.E.L.L.O.W.* (2001) at Geel, Belgium (Galland, 1994; Rhoades, 1994). Each time a strict scenography was followed designed by the artist in 1994 and again with his guidance in 2001.



Fig. 74 Jason Rhoades: original French fries, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.



Fig. 76 Jason Rhoades: *A.B.S. GUN* with *Pom Fritz Choke*, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.



Fig. 75 Jason Rhoades: *Aqua net* hairsprays, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.



Fig. 77 Jason Rhoades: thick-cut French fries, part of the installation *Piece in Ghent (P.I.G.)*, 1994, S.M.A.K.

During the whole creation process in 1994, Rhoades collected his drawings, exhibition plans with extensive explanations in a *Basic manual of observation and explanation* (Rhoades 1994). In this manual Jason Rhoades reveals his precise methodology for the installation. According to him, the instructions could be consulted, in the same way a medieval codex was used for interpreting religious works (Rhoades & Meyer Hermann 1998). On the front page of the manual Jason wrote: *However, Jason Rhoades reserves the right to change, alter or otherwise improve the product at any time without prior notice* (Rhoades 1994).

#### 7.1.2.2 Deterioration processes and condition of the fries

Materials	deterioration	preservation	remarks
French fries	physical degradation microbial growth mould growth lipid oxidation (fat) rancidity	MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary adding absorbers and/or scavengers will help to maintain optimal gas environment repackaging after exhibition

Fig. 78 Overview of degradation processes and preservation possibilities for the French fries, P.I.G.

Also in this case, it is required to gain insight which physical, microbial, chemical and/or enzymatic reactions can occur (Figure 78). In order to assess the degradation, by measuring the generic parameters pH and  $a_w$ , new similar looking French fries were produced. In this case study, it was not justifiable to use any of the original French fries, because these analytical measurements are destructive and would require whole French fries (Devlieghere et al., 2011). The pH and  $a_w$  of the newly produced French fries were measured in the laboratory of Food Microbiology and Food Preservation at Ghent University, Belgium. The results for the pH = 6,67 (measured by a pH electrode: Knick pH meter, Berlin, Germany) and for the  $a_w$  = 0,98 (measured with a cryometer: Type AWK-20 (NAGY messysteme GmbH, Gaufelden, Germany). These ranges of  $a_w$  and pH both allow growth and proliferation of microorganisms (Gilman et al., 201 b, pp. 2-3, Gilman et al. 2014a, pp. 3, Gilman et al., 2014b, pp. 2-3).

Further research into food degradation processes revealed that French fries are also sensitive to chemical degradation processes, such as lipid oxidation, resulting in off-odours. Lipid oxidation is omnipresent in fat containing food products, such as French fries. Once oxidation starts, a cascade of reactions will occur resulting in different types of decay. Such degradation processes can be under the detection limit (Samples, 2013). In this project, it was not possible to measure the degree of oxidation of the original French fries, because as before the methods used to measure oxidative rancidity (e.g. peroxide value determination or measuring free fatty acid concentrations) would have been destructive towards the artwork, again requiring a whole fry.

Conservators can use the knowledge of food science to understand the degradation processes that could occur when French fries were produced such as Rhoades did. Furthermore, the conditions in which they were stored and displayed after their production will also have an impact on the condition of the French fries.

In the case of *P.I.G.* the artist produced the French fried shaped potatoes by shooting whole potatoes with his *ABS gun*, a self-made gun consisting of a PVC pipe, metal clamps, wire, wire mesh, electric lighter, screwdriver and rubber packing tape. With this process his French fries were not identical (Figure 73-74 and fig. 77). After drying the uncooked potato strips he fried them in oil using a frying pan and one of his *King kookers* (Figure 72) (Rhoades, 1994).

The drying process caused a skin to form on the surface, which reduced vapour transport through the surface layer, resulting in a reduction of fat uptake. Rhoades produced thick-cut strips (Rhoades, 1994), which absorb less fat during the frying process and it seems probable the fat uptake was restricted to the surface of the sticks (De Meulenaer & Van Camp, 2007). This can also be derived from the relative high water activity ( $a_w = 0,98$ ), which was measured. Due to the heat applied during frying, the microorganisms present on the French fries were inactivated (Devlieghere et al., 2011). However, due to both moisture uptake and microbiological contamination from the environment during display and storage, the freshly fried potatoes can be considered to be microbiologically unstable. The French fries are most likely prone to moulding when displayed and stored in an oxygen-based environment. Also, the fat (oil) absorbed by the potatoes during the frying process is prone to oxidation, a process causing rancid offending odours when subjected to oxygen. It can be concluded that the freshly made French fries were not stable both from microbiological and chemical viewpoint.

At this point in time, those original French fries from the installation are dried out (thus  $a_w$  has decreased) and on inspection appear to be in a stable microbiological condition. Moreover, no mould activity has been observed to date.

### 7.1.2.3 Conservation issues and museum practices

As mentioned before, the installation *P.I.G.* has been limited to display at three different museums on four occasions, each time within the cage in which the original French fries were displayed. The different parts of the installation together with the fries are preserved in a storage area at S.M.A.K. under the environmental conditions: 18°C, 55% relative humidity (RH) and excluding light as much as possible (Bohez & Pauwels, 2011). The combination of fat uptake, and further dehydration due to the low RH during storage has helped in protecting the French fries from mould formation. From a water activity of 0,60, food is protected from mould formation (Devlieghere et al., 2011). As there is an equilibrium between the water activity of a food product and the relative humidity of the surrounding atmosphere, this has decreased the water activity and increased the microbiological stability of the fries (Devlieghere et al., 2011). If storage would occur at a higher RH, water uptake can be assumed and therefore mould growth expected especially if the French fries are also subjected to higher temperatures (optimum temperature for mould growth is 25°C) during future exhibition (Devlieghere et al., 2011).

The French fries have never been protected from oxygen during storage. This exposure to oxygen in combination with temperature fluctuations could increase the lipid oxidation, which can lead to rancidity (De Meulenaer & Van Camp, 2007). The fact that oxidation processes did not occur to date is probably due to the fact that the installation was not often displayed and, it can be assumed that the display conditions were in accordance with the storage conditions (apart from the exclusion of light). Such occurring degradation processes can be invisible. As neither rancid smell was noticed and, no destructive measurement could be used on the French fries, real objective evidence is lacking. Thus, conservators can only rely on educated assumption based on food science.

Furthermore, the traditional approach to conservation in which museum professionals do their utmost to preserve the original materials, is not necessarily the best solution to conserve complex installations. It is often perceived to be possible to promote a greater tolerance of aging or change for these types of artworks. Understanding the meaning assigned

by the artist helps in designing an appropriate conservation strategy (Scheidemann, 2010; Hummelen et al., 2008; Wharton, 2005).

After installing *P.I.G.* for the second time in 2001, museum professionals at S.M.A.K. decided to contact Rhoades to understand which information is important for the re-execution of future installations. Rhoades met with S.M.A.K. giving suggestions and advice. He also added texts, instructions and photographs to the work (Huys, 2001-2003). As the French fries were in good condition, their conservation was not discussed. In 2006 he died, thus, the only possibility to approach how the French fries should be conserved was by an interpretation of his general quotes and instructions in 1994 and 2001 and by an interpretation of the information in his *Basic manual of observation and explanation*. Therefore, for this case study, the contribution of the French fries towards the substantive meaning of the artwork was analysed, in order to develop a conservation approach.

It could be assumed that the presence of French fries are important to understand *P.I.G.*, because Rhoades viewed them as a Belgian specialty and as a recurring theme in many pictures by the well-known Belgian artist Marcel Broodthaers. Also, the fact that the fries were baked in oil, referring to the oil painting technique in Van Eyck's altarpiece, all contribute to their significance. In case the degradation of the French fries and dried potatoes increases to such a degree that the food becomes unrecognizable, one ought to consider whether they should be replaced and in what manner. Not only the presence of Belgian 'French' fries allude to the identity of the piece, but also the technique the artist employed to produce them are important to comprehend *P.I.G.*, as a *Piece from Ghent*, made in Belgium.

Quotations from the artist's view on restoration provided valuable evidence about the artist's intentions. To Jason Rhoades, restoration is a pathetic undertaking and his installations could take on ever-new forms at every re-installation (Rhoades & Meyer Hermann, 1998). In this perception, the existing decaying French fries should be preserved or recreated using Rhoades' method. In this theoretical study, these two conservation approaches were considered based on the interpretation of Rhoades' quotes and instructions in his manual.



### Preservation of the 'original' fries

Rhoades declared in his manual that the existing French fries from the first installation should be saved and re-installed, if nobody is able to shoot the French fry creating guns upon reinstallation (Rhoades, 1994). The artist produced five different sized guns for *P.I.G.* in 1994, which also form part of the installation (e.g. Figure 70 and 75) (Huys, 2001-2003). Important to notice is that, according to documentation, only one of the guns (Figure 71) was ever used by the artist, during his performances. Rhoades also produced a separate series of fifteen multiples of the *A.B.S. GUN with Pom Fritz Choke and Aqua net*, signed and dated (1994) by Jason Rhoades, enclosed with a separate user manual (Pauwels, 2015). One of the multiples belongs to the same Belgian collector as the one who owns *P.I.G.* and, a further belongs to the private collectors, Clayton Press and Gregory Linn (North America). In both these cases, the guns were once shot by the artist himself. Both collectors stated that they have an original can of *Aqua Net*. Realizing how powerful the gun is, they stated there is no way they would ever use it (Pastan, 2013). The installation *P.I.G.* consists of two individual *Aqua net sprays* (Figure 75) and one is fixed to on one of the guns (Figure 71) (Huys 2001-2003).

In Rhoades' perception, these fries were religious relics, which must be stored in a container (the cage). According to him reliquaries become identifiable because their colour is fading, substances are decaying, and the original forms can no longer be discerned (Rhoades & Meyer Hermann, 1998). This quotation could be an indication that for the artist, degradation of the French fries adds to their symbolic significance in this work. Arguably, the artist accepted the appearance of degradation of the French fries.

### Recreating 'French' fries

In his manual Jason Rhoades, on the contrary, declared that when *P.I.G.* is reinstalled and somebody is able to shoot the gun, the French fries could be reproduced. He explained exactly how to make an *ABS gun* and how to perform French fries: the gun could be loaded with potatoes, which are fired through a mesh that cuts them into pieces resembling the shape of French fries. The potato pieces may be cleaned up and left on the floor to dry. The frying pan that he used on the *King kooker*, must be filled with oil for frying. After the frying process, the French fries must be lined up (Figure 77) (Rhoades, 1994). The implication of these instructions is that it is acceptable to create new French fries. Thus, opening up this possibility to the conservator and curator in the future.



In 1984, a group of students and teachers from the *Ecole des Beaux-Arts de Bordeaux* (Atelier Pensée Nomade - Chose Imprimé, 1984) recorded their visit to the artist's studio in Los Angeles. This video shows Rhoades taking the group to his favourite DIY store in search of the parts needed to make an *ABS Gun with Pom Fritz Choke*. He explained how to make a potato gun and how to fire to create the French fries. In the video he also mentioned that everybody could produce the fries. Although, his usage of fries goes back at least to 1984, in *P.I.G.*, he attributed new significance to them in the context of the Ghent installation. Also, in his written instructions for the installation of *P.I.G.*, he states that the fries can be reproduced, which makes it conceivable for conservators to do so. Although, this approach could be followed, S.M.A.K. professionals have not reproduced them to date, because the originals are still in good condition (Pauwels, 2015) (Figure 73-74 and 77).

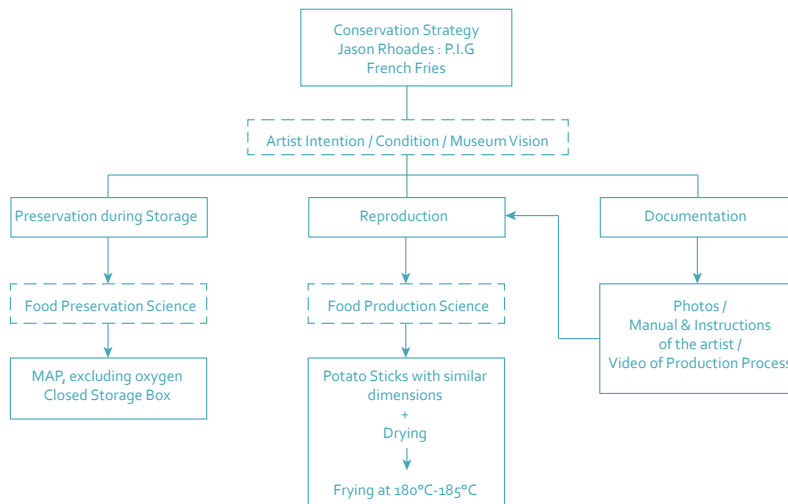


Fig. 79 Conservation strategy *P.I.G.* by Jason Rhoades: French fries

#### 7.1.2.4 Potential solutions and the role of food preservation (Figure 79)

##### Preservation of the 'original' French fries

During storage of the French fries, conservators could utilise food preservation knowledge. The most critical external factors in the preservation of the French fries are the low availability of oxygen combined with protection from moisture during prolonged storage

(Devlieghere et al., 2011). This reduction in oxygen can be obtained by gas-flushing, a technique in which the desired gas mixture is instilled into the packaging, while the air is expelled. It was demonstrated that the shelf life of food is increased through the reduction in the rate of chemical oxidation by lack of oxygen and in the growth of aerobic microorganisms, which are the major causes of food spoilage (Phillips, 1997).

As in the present case, the French fries are not consuming oxygen or significantly emitting gases, a high barrier material with a very low permeability to all gases is considered to be suitable. Alternatively, an enclosure containing 100% nitrogen could be used in order to displace the oxygen and thus eliminate the risk of rancidity and mould formation. Also, packaging and storing under MAP conditions has the advantage of protecting the artwork against moisture uptake. The fact that the French fries would be preserved into a closed package (which is required when using MAP), means the RH of the surrounding environment would not have a significant influence on the work. Furthermore, MAP has a good impact on the stability of the French fries during transport or exhibition.

Next to the use of MAP, stabilizing the environment instead is very useful for food-based artworks and is perfectly manageable in a museum environment without the need of special instrumentation. Especially for those works that are intended to perish and, for which conservators try to respect the artist's intention, by not treating the food products themselves, this method is useful. The application of temperature stabilization has already proven its efficiency for food-based artworks (Wharton et al., 1995). One of the most important factors in food-based art preservation is the maintenance of a stable temperature of 18-20°C and stable relative humidity of 55 %, which is realistic in a museum environment.

### Recreating French fries

If new French fries were recreated, production techniques applied in the food industry could be incorporated in the process in order to reproduce French fries that look, as close as possible, to the originals and could be preserved for the duration of an exhibition or even longer. Although, in the case of *P.I.G.* degradation processes were not detected until now, it is demonstrated that lipid oxidation and rancidity have to be considered for fat containing food materials. Knowledge of optimal frying conditions is important to produce French fries, in order to minimize the fat uptake, because it causes lipid oxidation and rancidity. In the food industry studies have been found that investigated the production of French fries

and the major factors that affect the fat uptake during the production (De Meulenaer & Van Camp, 2007).

Cracks and rough surfaces increase the surface area and thus increase the fat absorption. Ideally, the potato sticks need to be cut to the same dimensions in order to allow for uniform boiling. Also, drying the fry-shaped potatoes before frying them is important (Blumenthal, 1991). Upon addition of the food to the hot oil, the surface temperature of the food rises rapidly when frying, which causes the water at the surface of the food to start boiling. As the boiling commences, the convection will be further intensified by the water vapour. Due to evaporation, surface drying will occur and this will lead to shrinkage and development of porosity and roughness. Also, the water deep inside the food will become heated and in turn boiled. It is preferred to fry the food for a longer period of time as the moisture content in the crust will then slowly diminish, thereby reducing the boiling temperature of water. Several physicochemical changes take place, which can lead to beneficial organoleptic properties and colour of the crust. During the frying, not only water vapour but, also other compounds, will go from the food into the fat. This, combined with long-lasting high temperatures will lead to degradation of the frying fat (Mellema, 2003). Very high temperatures shorten the life of fat. The recommended cooking temperature is 180°C to 185°C (Mehta & Swinburn, 2001). Also, an increased number of fried batches degrade the frying fat, thus affecting the fat absorption. The fat content of the fried potatoes increases significantly with the number of fried batches (Blumenthal, 1991).

Food science recommendations	Original French fries	Remarks
Uniform size and shape	No	Adapt the frying condition for each single French fry.
Drying before frying process	Yes	
Regulated temperature of the hot oil	Yes	
Fresh batches of oil	yes	

Fig. 8o Food science recommendations for the reconstruction of French fries in order to resemble the originals.

When comparing how French fries should be produced, following food science recommendations with how they were produced by the artist, it became clear how the reproduction could be done in order to resemble the originals (Figure 80). So, during reconstruction of the French fries, agreement should be made on the shape and size of the French fries, frying conditions (type of oil, temperature and time) to be able to mimic the original French fries. Rhoades explicitly mentioned in his manual that the potatoes should be shot by his *ABS gun*. The consequence of this technique is that the French fries are different in size and shape. In order to obtain the best result for the different French fries, conservators could adapt the frying conditions for each French fry depending on their size and shape. Furthermore, Rhoades recommended to dry the potato pieces before frying, he regulated the temperature of the hot oil and used fresh batches of oil (Huys, 2001-2003), all important factors to produce French fries.

## 7.2. Museum practices, problems and application of food preservation techniques: 2 practical case studies

### 7.2.1. Joseph Beuys: *Wirtschaftswerte* (1980, S.M.A.K.)

#### 7.2.1.1 Creating context for conservation



Fig. 81 Joseph Beuys: *Wirtschaftswerte*, 1980, S.M.A.K.

In the previous chapter, it became clear that Joseph Beuys was one of the important artists who worked with food materials. In Beuys' oeuvre, the installation *Wirtschaftswerte* (*Economic Values*) (1980) (Figure 81) is one of the most remarkable pieces, in which his use of decaying food materials made part of its meaning. This installation is autobiographic, as each of the food materials is part of Beuys his personal vocabulary. To Beuys, the decaying food products, such as butter, honey, flower, chocolate etc. were an expression of energy and symbolized processes of transformation (Quaghebuer 2002). Change and evolution were an integral part of most of his works and are strongly represented in *Wirtschaftswerte*. The changing shape, odour and colour of the piece went hand in hand with evolutions in society, and still continue to give this installation and its material aspects their topical relevance.

*Wirtschaftswerte* was produced for the exhibition *Art in Europe after '68 (Kunst in europa na 68)* at the Museum of Contemporary Art in Ghent (S.M.A.K.) (Commandeur 1999, webiste cobra.be). Jan Hoet (the then director of the S.M.A.K., 1936-2014) acquired this work in 1980, which was quite controversial at that time. Hoet already had to deal with a lot of critique when he organized an exhibition with Beuys' work in 1977. After the acquisition of *Wirtschaftswerte*, Jan Hoet collected some other works by Beuys in which he used food, such as *Pasta* (1968) in 1982 and *Butter and Beeswax (basic material, 4bis)* (previous chapter) in 1987. *Wirtschaftswerte* was shown in various countries in different institutions, such as the Musée d'Orsay in Paris, the Stedelijk Museum in Amsterdam, the Prado in Madrid and the Nationalgalerie in Berlin (Quaghebuer 2002). Furthermore, this installation was exhibited during different major exhibitions at S.M.A.K., such as the opening exhibition (1999), *Barrio Beuys* (2005, S.M.A.K. and Museum of the 21<sup>st</sup> century in Kanazawa, Japan) and *All in the Present must be transformed: Matthew Barney and Joseph Beuys* (2006-2007, Deutsche Guggenheim, Berlin) among others. Also, the installation was loaned for the food exhibition *Das Große Fressen: Von Pop bis heute* and *De Gustibus... Rond eten in de hedendaagse kunst* (part 1).

*Wirtschaftswerte* consists of a metallic shelving unit, on which Beuys stored primary food products that he brought from East Germany. The artist generated a large number of packages with products from the anti-capitalist economy, such as rice, lentils, butter, bread, and honey with new symbolic meanings. Beuys chose unsophisticated packages that looked especially old-fashioned. The packages, which were also used by military and relief organizations in times of need, were surrounded with unbleached paper with a monochromatic print that only mentions basic information (e.g. content, weight) (Wittocx 2006). The installation had a couple of forerunners. From 1977 onwards, Beuys presented separate packages of foodstuffs manufactured in the Eastern bloc, which were similar as those integrated in the installation *Wirtschaftswerte*. Each package was signed and stamped *ein Wirtschaftswerte (one unit of Economic Value)*. All packages in the installation *Wirtschaftswerte* also bear this imprint. By signing all the packages and by giving them the title *Wirtschaftswerte*, Beuys emphasized the link between daily life and the transcendental art world (Quaghebuer 2002).

Next to the metallic shelving unit, Beuys surrounded the installation with paintings made during the life of Karl Marx, because of his appreciation of Marx analysis of the correlation between labour and economy. Although Beuys raised objections to the conclusions Marx drew from this analysis, when Beuys made this work, communism was a major political force and the Berlin Wall divided East and West Germany (website TATE). Beuys criticized the contemporary consumer society and the political situation in East Germany. He demonstrated the European divide, by the idea of chemical transformation in his highly critical and political installation. By selecting the products from what was then the Communist East Germany, Beuys actually questioned the separation of the two Germanies (Quaghebuer 2002). According to curator Eva Wittocx, Beuys his evocative representation seems to be simultaneously a kind of ode and a requiem for communism. With *Wirtschaftswerte*, Beuys referred to the hurt and trauma of a post-Holocaust Germany, whereby East Germany was designated both, as an accomplice in crime and, as a redeeming partner in the recovery. In 1980, the difference between the multi-coloured packages available on the free market in West Germany and the bland, single-coloured packages in the East was already striking; a difference that continued to persist until the Wall came down in 1989 (Wittocx 2006). To complete *Wirtschaftswerte*, Beuys added a block of plaster in which he rubbed fat onto a broken corner. Beuys stated that the owner of the piece should regularly rub fat onto the corner. The block of plaster symbolized the slow recovery of a sick society, healing steadily thanks to warmth and creativity. The fat had to penetrate slowly into the stone and finally entirely permeate it (Hoet 2001).

The viewer is confronted with the austerity of the packages, the rancid smell and the faded colours in *Wirtschaftswerte*. Especially, butter represented the creative force pre-eminently to Beuys, as it is a product of nature transformed by human labour and productivity. The use of fatty materials signified chaos and the potential for spiritual transcendence (chapter 6). By placing all these, in the first place looking banal products, on a shelving unit and, by putting this rack in a museum (instead of the usual warehouse), Beuys disturbed the institutional meaning (Quaghebuer 2002).

### 7.2.1.2 Deterioration processes and condition of the food (Fig. 82)

Materials	deterioration	preservation	remarks
Dry products: flour, sugar, rice spice, herbs	physical degradation of packaging materials damage by insects microbial growth mould growth oxidation	Replacement of non- visible food materials by less perishable materials Protection against moisture MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary adding absorbers and/ or scavengers will help to maintain optimal gas environment repackaging after exhibition
Chocolate, honey, dextrose	Fat and sugar bloom	Replacement of non- visible food materials by less perishable materials Protection against moisture, temperature stabilization MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary adding absorbers and/ or scavengers will help to maintain optimal gas environment repackaging after exhibition
Canned foods: pickles, sauerkraut, lentils and peas	Spoilage by yeasts, moulds and LAB (lactic acid bacteria) oxidation	MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary adding absorbers and/ or scavengers will help to maintain optimal gas environment repackaging after exhibition
Butter	microbial growth mould growth lipid oxidation (fat) rancidity	MAP, excluding oxygen (100% N <sub>2</sub> )	special equipment is necessary adding absorbers and/ or scavengers will help to maintain optimal gas environment repackaging after exhibition

Fig. 82 Overview of degradation processes and preservation possibilities for the food materials, *Wirtschaftswerte*

Over the years, *Wirtschaftswerte* underwent some changes: the packaging surrounding the food materials degraded, the butter became rancid and quite a number of food products deteriorated. Especially the dry products, such as flour and sugar were damaged by insects and perished gradually.



A few years after its acquisition in 1980, conservators at the museum interchanged the content of several food packages with less perishable materials, because of extensive degradation. The artist agreed to have the content of some packages replaced by a mixture of sand and lime, corresponding to the weight and volume of the original package. (Wittocx 2006). Other packages still contained food products. Because the replacement of certain food products was at that time not fully documented, it was not clear which packages still did contain their food content and which were replaced (Huys 2008).

The food products that were used by Beuys were mostly dry food products, like flour, sugar, rice, spices and herbs. These products are characterized by a low  $a_w$ , which means that they are microbiologically stable. For instance, flour is a milled cereal product and is microbiologically stable, if the moisture level is  $< 12\%$ . If the  $a_w$ -value increases, because of moisture uptake, fungal growth can occur and yeasts and bacteria could grow. The  $a_w$  of sugar or products, such as chocolate, honey, and dextrose, all food products used by Beuys that contain a lot of sugar, will also increase in environments with a high RH and, will be susceptible to spoilage (Devlieghere et al 2011). Chocolate is sensitive to the development of fat and sugar bloom, which occurs due to exposure to moisture or extreme changes in temperature (Longchamp and Hartel 2004) (chapter 5). Furthermore, honey constituents, such as sugars, volatiles, beeswax, nectar, pollen and propolis, have been characterised as responsible for an antimicrobial activity. The moisture content of honey is an important factor, which contributes to its stability against fermentation and granulation (Kucuk et al 2007). Also other food materials in *Wirtschaftswerte*, such as the coffee compounds, spices and herbs have antimicrobial properties (Martinez-Tomé et al 2011). Spices and herbs are susceptible to spoilage after moisture uptake (Devlieghere et al 2011).

Furthermore, Beuys used canned food, such as pickles and sauerkraut (very acid,  $\text{pH} < 3,7$ ), and lentils and peas (semi-acid,  $\text{pH} = 5,3-4,5$ ). Acid canned food products are susceptible to spoilage by yeasts, moulds and lactic acid bacteria. Mostly, this kind of spoilage is due to insufficient heating, during the production of the products or, due to leakage of the cans (Devlieghere et al 2011).

Lastly, Beuys rubbed the fat (butter) on a plaster block and put it in front of the metallic shelving. Butter has a high  $a_w$  and is sensitive to mould and yeast growth (chapter 6, *Butter and Beeswax*).

Because of the fragility of the packages, it was not possible to open the packages, in order to determine the condition of the food inside. An optical analysis, by food scientist Peter Raggaert, helped to understand which were the main causes for the degradation of the food products in this installation. During display periods, the food materials in their paper packages were exposed to moisture, which they absorbed. Since it was not possible to know how much moisture was present in the various food products, there could be traces of mould present inside the packages prior to their display. Especially, the paper packages with sugar, flour, rice and other dry products should be protected against moisture absorption, in order to prevent the formation of mould. During the storage of the dry food (such as sugar and flour), chemical processes, such as oxidation and lipolysis of fat, can be formed. Excluding oxygen in the surrounding atmosphere can be helpful, to avoid those chemical processes (Raggaert 2010). Also, for the other materials, such as the chocolate, moisture has a negative influence. Temperature stabilization is required, as it proved to be very effective for the preservation of sugar and chocolate (see before).

### 7.2.1.3 Conservation issues and museum practices: application of the food preservation technique MAP (100%N<sub>2</sub>)

Often, museums, housing Beuys' sculptures and installations, pertained to environmental preservation, during storage. After the acquisition of *Wirtschaftswerte*, museum professionals at S.M.A.K. documented the work and, in the following years, the artist communicated with them to explain the overall concept of his installation (Huys 2008). Furthermore, the descriptions of the conservation decisions, made for other food-based artworks by Beuys (for instance *Fettecke in Kartonschachtel*, *Butter and Beeswax* described before) and, his statements, concerning the patina of his materials (previous chapters, Mancusi-Ungaro 2009), afforded extra insight to understand *Wirtschaftswerte*.

Here, the material-related ageing was accepted by Beuys and was part of his concept, as he stated about *Wirtschaftswerte* (website TATE): *My sculpture is not fixed and finished. Processes continue in most of them: chemical reactions, fermentations, colour changes, decay, drying up. Everything is in a state of change.* Furthermore, when Jan Hoet acquired *Wirtschaftswerte* in 1980, the artist specified that the content of some packages could be replaced, as long as the image of the artwork remained intact. Indeed, according to other resources, Beuys welcomed change in his materials, linking it to the process of regeneration and, referring to his own biography story (previous chapters). By signing the paper packages and, by indicating that the visual image of these packages was important,

Beuys designated that the packages of the food materials could not be replaced.

In the beginning, museum professionals at S.M.A.K. misinterpreted Beuys' instructions, as they replaced some of the food by materials that, according to the artist, did not correspond with the image he wanted to create (for example, by replacing flour with polystyrene beads). After Beuys met with the museum, he indicated specifically which materials the conservation specialists were entitled to use as replacement. For instance, he agreed to have the content of the flour packages replaced by a mixture of sand and lime, corresponding to the weight and volume of the original package. Also, with his agreement, a chocolate bar was replaced by a piece of wood. But, the wrapping paper of the chocolate bar had to remain the same (Hoet 2001 & Huys 2008).

Thus, the replacement of the food materials was possible as long as the visual image did not change. Replacing the content of the non-transparent packages was possible, as long as the structure of these materials resembles the 'original' materials (Hoet & Huys). Furthermore, Beuys indicated that the block of plaster with the 'fat corner', regularly, should be rubbed in with fat (see above). Drawing on Beuys' statement, about the visual image that could not change, conservators rub the block in with fat every time it was on show.



Fig. 84. Joseph Beuys: *Wirtschaftswerte*, Plexiglas storage cases.

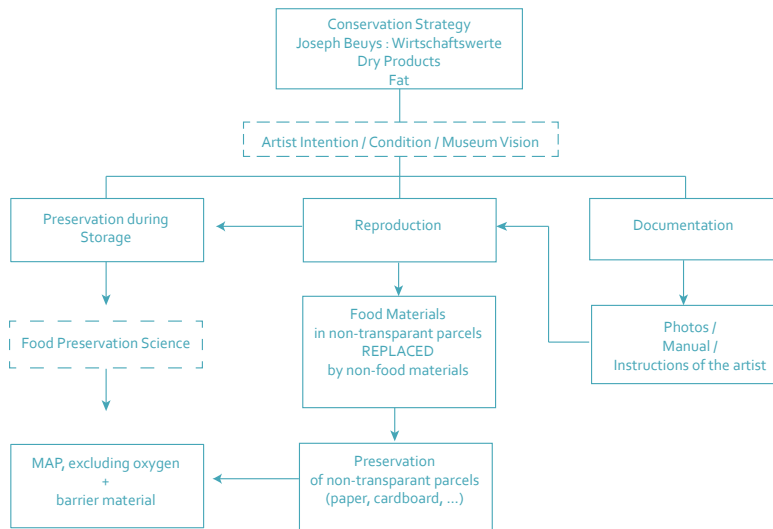
According to the statements about the visual image of *Wirtschaftswerte*, it could be assumed that certain food products, such as the fat and honey, stored in glass containers, should not be replaced, since these food products were visible. Therefore, conservators were considering

employing food preservation techniques during storage. Drawing back on the experimental research (described in chapter 6), conservators at S.M.A.K. decided to use MAP. In order to protect the food materials against insects, oxygen should be removed from the surrounding atmosphere (Raggaert 2010). Therefore, N<sub>2</sub> was used. Museum professionals developed several Plexiglas storage cases (Figure 84), based on the boxes made for the experiment (chapter 6). Also here, the cases contain two side-openings, through which N<sub>2</sub> gas was flushed. The boxes were filled with all the materials (e.g. paper packs, glass containers, etc) cushioned with Ethafoam, spin polyester and Tyvek (all cushioning materials usually employed in museums). Those cushioning materials were chosen, because they are permeable for the gases. After sealing the boxes with silicone gel and screws, the lid of the boxes were closed. When the boxes were filled with N<sub>2</sub>, silicone plugs were used to close the side-openings. The different Plexiglas boxes were then integrated in a bigger wooden crate with different compartments (Figure 84). This wooden craft was stored in an air-conditioned storage area with environmental conditions of 55% RH, 18°C and, light intensity kept at its minimum, as this room is accommodated with light timers and dimmers.

Although, this food preservation technique was developed to store *Wirtschaftswerte* and, the intent of the conservators was to transport the installation in MAP conditions, in practice this method was not always applied. The flushing period took too long, because of the size of the boxes. The materials, such as the gas bottle and the flushing tube, necessary to perform this technique, were not always available on the places where the installation had to be exhibited and packed afterwards. Because the use of MAP is not common in contemporary art conservation practice, the application of it still has to be mastered by conservators.

#### 7.2.1.4 Proposition for improvement of the application of the preservation technique (Figure 83)

The biggest problem with the actual preservation technique is the duration of the flushing period. This practical problem could be solved, by producing smaller boxes or, by integrating different barrier films, with some of the food packs, into the actual boxes. Barrier films are smaller and, therefore, the MAP conditions should better be maintained. The flushing period for smaller boxes or for barrier films would significantly be reduced.



**Fig. 83** Conservation strategy *Wirtschaftswerte* by Joseph Beuys: dry products and fat

Furthermore, the museum only employed  $N_2$  to obtain MAP conditions in the boxes, in order to protect all materials against oxidation. The paper packages, with sugar, flour, rice and other dry products, should be protected against moisture absorption, in order to prevent the formation of mould (Raggaert 2010). Also, the dry food should be protected against oxidation and lipolysis of fat. By adding  $CO_2$  and, by adding  $N_2$  (as filling aid) in the protective atmosphere, it is possible to avoid the chemical processes.  $CO_2$  is, typically, an antimicrobial agent and thus, has an impact on the microbiological spoilage (Devlieghere et al 2011). Next to the application of those food preservation techniques, a stable storage environment, maintaining a RH = 60-70%, a maximum temperature of 16°C and light kept at its minimum, will be necessary to slow down the degradation processes.

Also, museum professionals at S.M.A.K. collected back-up material in their artist boxes, which could be used for the replacement of some of the materials, such as spices, herbs, dextrose and coffee essence (Huys 2008).

## 7.2.2. Wim Delvoye: *Autoportrait* (2005, Métissages MIAT)

### 7.2.2.1 Creating context for conservation



Fig. 85 Wim Delvoye: patterned floors with pieces of deli Belgian meat

The Belgian artist Wim Delvoye (1965) is known for playing seriousness against irony, by combining fine arts with folk art. His works are anchored in the Flemish culture. The eclectic art of Delvoye resulted in a highly developed form of popular art. The ambiguous nature of his objects reflects the ambivalence of today's culture, a culture that is in search of a new harmony between the reality of the moment and the romantic glorification of the past. Delvoye extended the work of Andy Warhol by creating 'factories', such as his *pig farm* and his *Cloaca factory*. Not to

mention his playing with logos and brands, writing his name in the manner of Walt Disney and calling his website *Wim City*. Like the Disney Corporation, Delvoye likes his work to be well made and, a team of specialists assists him to realize his art projects. In *Wim City*, everything, from the library, the jewelry, the destroyed pieces, the photos, the chantier, the shop, etc., are considered to be 'art' (website Delvoye). As an autodidact, he is constantly collecting and processing knowledge and, he uses a whole range of marketing strategies, reconcilable with the creation of his art. Just like Jan Fabre, Wim Delvoye is an artist who is also an emancipated entrepreneur (De Baets and Tratsaert 2004). One of the major aspects in Delvoye's working life is that his oeuvre is not easily categorized into time-limited series. Whether Delvoye is supervising the production of tattooed pigs, combining gas canisters with Delft patterning, turning ironing boards into heraldic emblems, making patterned floors out of hundreds of pieces of deli Belgian meat (Figure 85) or, embroidering figures and cartoons on ham slices, he is always making connections between things that have no apparent relationship prior to his aesthetic hybridizing. His works incessantly generated new meanings and, they evoked associations and links between craft practices, popular traditions and historical references (Van Den Abeele 2000).



Fig. 86 Wim Delvoye: *Cloaca*

Often, Delvoye his artworks are connected with food. He is well known for his digestion apparatuses *Cloaca* (2000-...) (Figure 86), which are complex machines for the production of food (Groos 2009). The twelve meters long apparatuses materialise the phenomenon of digestion. The food that passes through the machines is ingested and goes through all the successive states of being digested, before it is eliminated and expelled (Fréchuret 2004). References can be made to the work *Artista di Merda* (Figure 9) by Manzoni, as none of the machines are for sale, only the final product is. With his 'shit' Delvoye launched a small marketing machine of *Cloaca* t-shirts, toilet paper and other paraphernalia (website Delvoye).

Wim Delvoye made also pieces that consisted of collages of cheese labels from 'La Vache Qui Rit', pictures of potato peels, embroidered ham, *marble floors* made with slices of meat and the cibachromes of these floors. Those works are categorized in his *Wim City* under 'destroyed pieces', as those works never survived. Sometimes, they were exhibited, but because of their perishable nature, they were thrown away afterwards. When 'clicking' on the 'destroyed pieces' on his website, the visitor is guided towards the 'photo' section, where pictures (often cibachromes) of those destroyed pieces remain. In those works, the image was confronted with the identity of its material support, leading to new objects and new images. For Wim Delvoye, the realisation of an artwork is as important as the idea. Since his 'marble meat floors' or his



'embroidered slices of ham' didn't last for long, he registered them before and/or after the transformations (website Delvoe).

Thus, his ephemeral objects and installations with meat were more the process of his art making, which he exposed once and, it was never his intention to let them last forever. Afterwards, he perpetuated these works by replacing them by photos and prints, which allow him to conserve his works. According to the artist's assistant Gianni Degryse, Delvoe his *marble floors*, which were made of salami and ham slices, were immediately photographed after their creation (Figure 85). In the morning, the artist and his team cut the slices of meat and laid the meat slices on the floor right after. The meat slices dried out very quickly and, once they started shrinking, they were not in accordance with the original pattern in which they were supposed to fit. Those meat materials were only the medium by which the artist made his artwork, but were not the work in itself (Degryse 2011).



Fig. 87 Wim Delvoe: part of the artwork *Autoportrait: Chantal* (1995)



Fig. 88 Wim Delvoe: part of the artwork *Autoportrait: Smoking Boy* (1995)

Wim Delvoe his artwork *Autoportrait (Chantal* (Figure 87), *Catherine, Smoking Girl and Smoking Boy* (Figure 88)), consisted of dried cured ham slices on which cartoons were embroidered. In order to facilitate the embroidering activity, the ham slices were slightly frozen. After the embroidery the work was photographed. During the embroidery and photography of the work, the thawing process of the slightly frozen ham slices started. Thereafter, these dried cured ham slices were packaged in butcher paper and stored in the artist's home freezer for almost ten years



before they were displayed in 2005 (Degryse 2011). The embroidered raw cured meat slices belonged to his personal collection and were used for the exhibition *Mé-TISSAGES. Biennale rond kunst en textiele media (Mé-TISSAGES. Art and textile Biennale, MIAT 2005)* (Figure 89-90). The *Biennale on art and textile* brought together reputed Belgian and international artists (among them Jan Fabre, Louise Bourgeois and Berlinde De Bruyckere), who chose needlework to draw their images. The name *Métissages* originates from the French 'tissage', which literally means 'weaving'. This exhibition explored the boundaries between handicraft and art, by interweaving art, textile and textile industries on different levels (Windels 2005).



Fig. 89 Wim Delvoye: *Autoportrait* (*Chantal, Catherine, Smoking Girl and Smoking Boy*) produced in 1995 and presented in 2005 in a Modified Atmosphere display case.

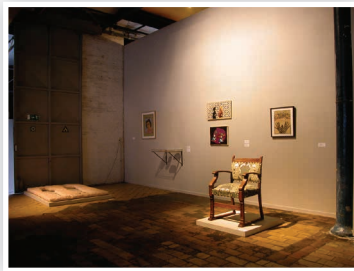


Fig. 90 *Autoportrait* presented during the exhibition *Mé-tissages, Art and Textile Biennale* (26 March – 16 May 2005)

In 2004, similar ham slices were shown during the exhibition *The Story of Thread: Needlework in Contemporary Art* in The Museum of Modern and Contemporary Art of Trento and Roverto (MART) in Italy. Unfortunately, those slices did not survive the exhibition. Because of their rancid smell and their extensive degraded form, the gallery director decided to remove the work after a few days (Degryse 2005).

According to Wim Delvoye, it was not his intention to preserve *Autoportrait* (Figures 89-90) after the exhibition *Mé-TISSAGES*. Just like in other of his meat works, Delvoye used the food products just to expose the process of his art making, but it was never his intention that his food-based artworks last forever (Degryse 2005). A lot of Delvoye's works referred to the 'ready-made' introduced by Duchamp. His objects became artworks, because of the museum context in which they were placed. This was also the case for his work *Autoportrait*. By shocking people, he questioned society and tried to initiate discussions. There is this obvious criticism of

recognizable pictures and figures, but by embroidering them on meat slices and placing those in an artistic context, his images reflected the ambivalence of today's culture and evoked associations between craft practices and popular traditions (Van Den Abeele 2000), which was also the case for *Autoportrait*. Since his 'meat works' degraded rapidly, he registered them before and/or after the transformations, by replacing them with photos and prints (De Baets and Tratsaert 2004). The artist's assistant Gianni Degryse confirmed about *Autoportrait* that Delvoye didn't take those kinds of artworks seriously. These slices were more like a Delvoye label and *spielerei*. Some slices were produced to use them as flyleaves for a catalogue and some of the slices were printed as C-prints (100 x 125), to offer for sale to galleries (Degryse 2005).

#### 7.2.2.2 Deterioration processes and condition of the food: cured smoked ham (Figure 91)

Materials	deterioration	preservation	remarks
Raw cured ham	physical degradation	MAP, excluding oxygen (50% N <sub>2</sub> , 50% CO <sub>2</sub> )	special equipment is necessary
	colour instability (brownish)		adding absorbers and/or scavengers will help to maintain optimal gas environment
	microbial growth		
	mould growth		
	lipid oxidation (fat)		frequent measurements of the gas composition during display period
	rancidity		

Fig. 91 Overview of degradation processes and preservation possibilities for *Autoportrait*

When *Autoportrait* was taken out of the freezer in 2005, they smelled rancid due to lipid oxidation. It can be assumed that the temperature in the artist's home freezer was around -18°C, which allowed fats to further oxidise and, which increased the rancidity. The rancid odour was due to lipid oxidation, which is omnipresent in meat and other fat containing food products. During the production process of *Autoportrait*, the dried cured ham slices were subjected towards freezing and thawing. To store them, they were refrozen. Thawing and refreezing processes can negatively influence structural and chemical properties of meat and increase lipid oxidation. The amount of unfrozen water is one important factor for oxidation. This amount depends on the freezing temperature, ideally -40°C, which was not the case here, because the ham slices were stored in a home freezer with a temperature around -18°C. Besides the

temperature, the formation of ice crystals during freezing is a critical point. The more homogeneous and the faster the freezing happens, the smaller and the more uniform the formed ice crystals will be, which is an important element to avoid increased oxidation after thawing. Once frozen, it is important that a stable temperature is kept, as temperature fluctuations lead to the formation of bigger crystals (Samples 2013). Most certainly, the temperature in the artist's home freezer was not kept constant during the 10 years of storage (Samples 2013). Furthermore, the dried cured hams were packaged in butcher's paper, thus not protecting them from oxygen. This exposure to oxygen in combination with temperature fluctuations increased the lipid oxidation in *Autoportrait*, which led to rancidity and off-flavour (Devlieghere et al. 2011).

In this case, it was not possible to measure the degree of oxidation, because methods to measure oxidative rancidity (e.g. peroxide value determination or measuring free fatty acid concentrations) would have been destructive towards the artwork. Thus, food scientists could only rely on general preservation parameters for dried cured ham.

Considering microbiological spoilage, following parameters of the food matrix are important: the acidity value (pH, being the  $-\log$  (proton concentration) and the water activity ( $a_w$ ). Dried cured ham has an  $a_w$  value of  $0,92 \pm 0,015$  and pH of  $5,60 \pm 0,12$  (Clinquart et al. 1998). Therefore, microbiological proliferation and mould growth can be expected when the ham slices are subjected to higher temperatures during display.

Besides microbial growth and lipid oxidation, another concern to preserve meat products is colour stability. The colour stability of meat products is influenced by a large number of biochemical factors. A shift from a red towards a brown colour of meat occurs due to binding of oxygen on 'myoglobin', the compound responsible for oxygen transport in muscles. In this way, 'metmyoglobine' is formed and a brown colour is obtained. Treatment with nitrite salt in the curing process stops this phenomenon and a red colour is maintained in dried cured meat products (Jakobsen and Bertelsen 2003). As the work was frozen for 10 years and subjected to oxidation, with loss of 'metmyoglobin', it resulted in a light brown colour, but not extremely pronounced. As long as the dried cured ham slices were kept in the home freezer, these deterioration processes were slowed down (or completely inhibited). When taken out of the freezer and subjected to ambient temperatures, decay processes were accelerated.

### 7.2.2.3 Conservation issues and museum practices: application of the food preservation technique MAP (100%N<sub>2</sub>)

Because of the perishable nature of artworks with food, short-term exposition periods, such as was the case for *Mé-TISSAGES* from 26/03 to 16/05 2005, can be problematic. As the curator Isabelle De Baets, had already the experience with the unintended early removal of the organic installation with slices of smoked ham by Jan Fabre (introduction), she was conscious about the degradation problems that could occur in such food-based artworks.

Drawing on this experience and the experience of the display of similar ham slices, which were thrown away after a few days, during the exhibition in Italy in 2004, the curator of the exhibition in MIAT searched for a solution to show *Autoportrait* for the whole duration of the exhibition. Museum professionals were especially worried that the audience would be hindered by the smell.

In cooperation with the Department of Food Safety and Food Quality (Ghent University), the modelling of a MAP system, to present the artwork, was developed. The most critical external factors to preserve cured meat products were identified to be low availability of oxygen combined with exclusion of light and low temperature (7° C) to prevent degradation (Jakobsen and Bertelsen 2003). Thus, these factors had to be considered to preserve the work for the exhibition period. Because of the exposition context, it was not possible to create temperatures lower than 18° C, nor was exclusion of light possible. Consequently, only protecting the ham from oxidation by minimizing oxygen levels was considered.

Rancid odour was the biggest concern for *Autoportrait*. Therefore, exclusion of oxygen was needed. Due to the lower  $a_w$  of the ham slices, no real direct concern could be extended towards microbiological spoilage, but mould formation could occur. The colour stability was acceptable, according to the artist and curator of the show. Therefore, it was decided to exhibit *Autoportrait* in a 100% N<sub>2</sub> showcase, protecting the work from oxygen and rancidity. The showcase consisted of a polyacrylate case, as it offers a good barrier towards gasses, with two valves into each side of the case (Figure 89) (Devlieghere et al. 2004). The case was filled with the artwork and sealed with silicone gel and screws to avoid leakages. Afterwards, it was flushed with N<sub>2</sub>. When the case was filled with the particular gas mixture, silicone plugs were used to close the side-openings. The composition of the headspace was measured during the

flushing period, by using a CO<sub>2</sub>/O<sub>2</sub> gas analyzer (Servomex food packaged, series1400, UK). During the exposition period, the gas composition was not measured, neither reflushed with N<sub>2</sub>.



Fig. 92 Wim Delvoye: part of the artwork *Autoportrait (Catherine)* after 3 weeks of display in a modified atmosphere: mould development.



Fig. 93 Wim Delvoye: part of the artwork *Autoportrait (Chantal)* after 3 weeks of display in a modified atmosphere: mould development.

After three weeks, mould development was noticeable on two of the four slices (*Catherine* and *Chantal*) (Figure 92 and 93). At the end of the show, all meat slices were discoloured (also *Smoking Girl* and *Smoking Boy* (Figure 94- 95), as the temperature in the exposition room was too high (18-20 °C) to preserve the meat. Indeed, all changes that occur in chilled meat during display are likely to be accelerated by increasing temperature (Gill 2003).



Fig. 94 Wim Delvoye: part of the artwork *Autoportrait (Smoking Girl)* after 1,5 month of display in a modified atmosphere.



Fig. 95 Wim Delvoye: part of the artwork *Autoportrait (Smoking Boy)* after 1,5 month of display in a modified atmosphere.

As the work belonged to the collection of the artist, the ham slices were returned to him, once the exhibition was finished. He threw those slices away, as for him they were not presentable anymore and, he had previously photographed the work in order to preserve it. Thus, *Autoportrait* continued to exist in another medium.

#### 7.2.2.4 Proposition for improvement of the application of the preservation technique (Figure 96)

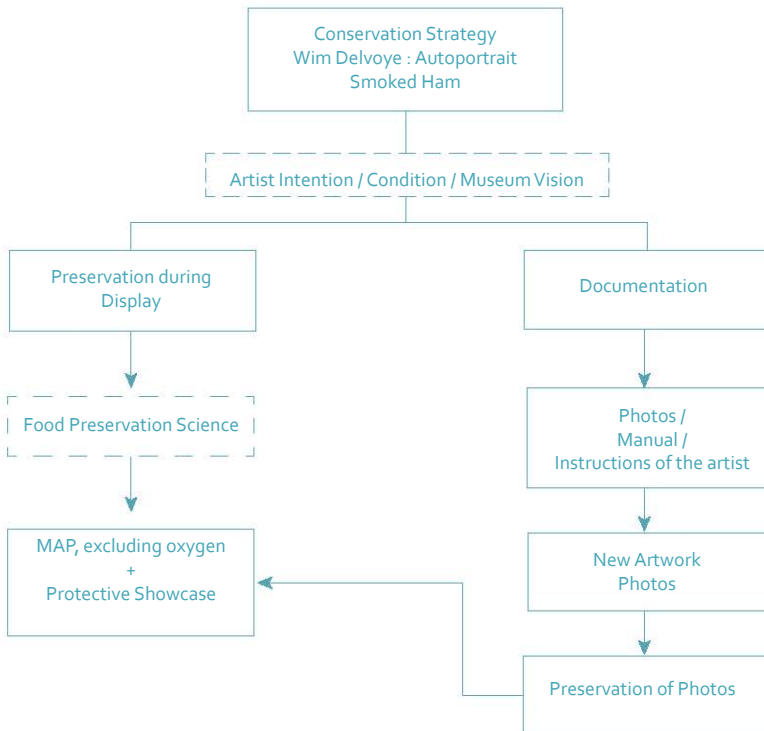


Fig. 96 Conservation strategy *Autoportrait* by Wim Delvoye: embroidered raw cured meat.

The dried cured ham slices showed degradation processes before they were displayed, due to the production process of the artwork (freezing and start of thawing process) and, due to their storage context (refreezing and exposure to oxygen).

By presenting the work in an oxygen-free display case, the most critical factor (oxygen) that increases rancidity and the further colour degradation could be minimized. The preservative exposition case maintained an acceptable appearance and odour for the meat product, during the first weeks of the exhibition and thus, slowed down the onset of spoilage.

The reason why the mould development was visible on two slices (*Chantal* (Figure 92) and *Catherine* (Figure 93)) and not on the other two slices (Smoking Girl (Figure 94) and Smoking Boy (Figure 95)) was not clear. There could have been a difference between the qualities of the particular meat slices that were affected, because of the various atmospheres to which they were exposed. As the quality of the different slices was not known beforehand, it was impossible to evaluate why some of them became mouldy and others did not. Due to the fact that two out of four slices demonstrated mould growth, it could be expected that a leakage occurred during the exhibition and thus, the optimal gas atmosphere of 100% N<sub>2</sub> was not maintained. Probably, the showcase was not perfectly sealed and micro-leakage in the silicone led to an increase of oxygen concentration inside. Because of moisture uptake and microbiological contamination from the environment, the meat slices became microbiologically unstable and moulding started (Devlieghere et al 2011). This can be avoided by frequently measuring the O<sub>2</sub> concentration inside the boxes, during the exposition period and, by re-flushing N<sub>2</sub>, when O<sub>2</sub> concentration increases.





## PART 4: General discussion and conclusion: The role of science in the conservation and presentation of contemporary food-based art

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### 4.1. New strategies for the conservation of food-based art

Throughout this PhD-research, the importance of scientific research for the preservation of food-based art was demonstrated. The aim was to re-examine the strategies and methods of traditional art conservation in the light of new strategies, which have been used for the conservation of contemporary works of art and, to present a methodology that offers a framework to manage specific problems, related to the conservation of ephemeral food-based artworks. In order to evaluate the role of science, it was necessary to establish the context, needs and objectives of food-based art. Therefore, it was important to outline the origins of food-based art, in order to understand the significance of some of these specific kinds of artworks. Through the history of modern art, artists applied food products creatively in various ways and consequently food-based artworks imply different messages. Different concepts were addressed and, still are explored, by artists producing food-based artworks, such as ephemerality, mass consumption, decay, infestation of the museum, performativity (e.g. artworks in which cooking and activated spectatorship were integrated into a 'living artwork'). In the history of food-based art there was no linear trajectory of historical developments. Rather, food-based art appeared to include competing definitions, overlapping with one another and operating simultaneously in various artistic practices, sometimes, even within a single artist's project.

Reviewing and contextualizing food-based art was necessary to gain insight in the artists food-based art practices. At first, the tangible deployment of food products in artworks was a reaction from many artists against the art institutions. Many works of the 1960s and 1970s were explicitly intended to resist the institutionalization, operating in the capitalist art market. Initially, ephemeral food-based art was created outside the museum, to avoid commercial mechanisms of the art market and related institutions. For artists, such as Manzoni, Oldenburg, Matta Clark, Spoorri, Broodthaers and Roth, ephemerality was used as a means to reflect about issues in the art world and to democratize or challenge museums. Consequently, the artworks they created challenged the values of conservation, by questioning notions of permanence and, by prolonging the physical life of the artworks in the face of inevitable change.

The conservation issues of changeable artworks were not new, but a clear framework for the conservation of perishable artworks was still lacking. In the past years, a greater attention to the art object and its materiality enhanced the study of art history. The focus on the materiality of artworks offered insights into the meanings of ephemeral and conceptual artworks. Materiality and the preservation of conceptual artworks made of perishable materials, such as food, became problematic. More than once, this took conservators to uncomfortable places. In traditional conservation the preservation of a physical object by the means of scientific and technological research was ruling, as the meaning of the object in a material sense is generally unambiguous. With contemporary art, in which change was consciously integrated, the very diverse materials and techniques the artists used, often carry their own meaning. Because the relationship between material and meaning in contemporary works is usually ambiguous, conservators searched for new strategies, in order to preserve the more intangible aspects of those artworks.

New strategies for conservation were explored, based on managing the variability inherent in these works. Often, it was perceived to be far safer to promote a greater tolerance of aging or change on those works of art, without the application of a treatment by the means of science. However, the downside to this was that for perishable food-based art, the works would disappear, if conservators did not apply any kind of treatment to them. The representation of a material object appeared to be one of the most powerful tools to visualize, for instance, degradation of the material.

The new strategies in conservation mainly focussed on contextual investigations, in order to gain insight into the production processes of art, the way artworks entered the art-market and evolved during the following years. Those contextual investigations turned out to be necessary to capture the functionality of art materials, such as food. By investigating the context of food-based art the reason of deployment of food materials and, the new meanings that were given towards artworks, when they moved over the years and between several cultures, became clear. Conservators must indeed understand that bigger picture and analyze the overall context (art historical context, meaning and cultural significance), before any conservation treatment could be proposed. It was arguable that scientific research (material research, principles of preventive preservation) would play a crucial role in the assessment of the condition of the work and, in the development of treatment possibilities for food-based art.

Because of the perishable nature of food, it was demonstrated that scientific research contribute to the transmission of food-based artworks to future generations. It became apparent that in a lot of food-based art, conserving the degradation of the food is required, such as was the case food-based works by Roth, Beuys, Leonard and De Cupere. Chemistry and technical studies can contribute to maintain the aesthetic shape of the processes the food materials are required to generate. Also, for artworks in which the food materials had to be replaced on a regular basis, knowledge on food science appeared to be useful in order to reproduce food-based art. Even when the replacement and/or reproduction of specific food products was necessary because of consumption (e.g. Felix Gonzalez Torres' candies) or, because the food products should look fresh (e.g. Sarah Lucas' eggs and kebab), insight in food science turned out to be necessary.

#### 4.2. Reaching the level of understanding of food materials: incorporation of preservation knowledge from the food industry

In order to preserve food-based artworks, it was important to gain insight into the main degradation processes of food products and food preservation techniques that could be implemented in art conservation. Certain intrinsic food preservation parameters, such as  $a_w$ , Eh and antimicrobial constituents of food products, which are less commonly known by art conservators, seemed important in order to understand the degradation processes of food materials. Also, the degradation of food materials is depending on the kind of food and the external parameters in which they were preserved. The main difference between food materials and more traditional art materials appeared to be the required environment in which they should be preserved, with a higher relative humidity (RH: 60-70%) and lower Temperature ( $T < 4^\circ\text{C}$  or  $< 10^\circ\text{C}$ ) for most of the food than those applied in museum storages (RH = 55%,  $T = 18^\circ\text{C}$ ). Therefore, food materials, which are part of artworks, require a separate refrigerator. Next to the specific food preservation parameters, art conservators have to bear in mind that a lot of food-based artworks imply adapted food materials, in which artists treated them with other materials (e.g. the embroidered fruit peels or raw cured meat slices) or, in which artists treated the food to protect them against degradation (e.g. part of the artwork *Strange Fruit* in which the fruit peels were treated with the consolidant B 72).

When studying food preservation techniques applicable in the museum context, it became clear that certain food preservation techniques, focussing on the creation of an anoxic environment, were already applied for traditional artworks and for some contemporary artworks, but that their use is rather unusual in the context of contemporary art. Previous applications in a museum context emphasized that these techniques were effective in slowing down the rate of deterioration of art materials. Furthermore, by comparing the preservation requirements for food products in the industry with art materials, it became apparent that there is no single preservation strategy that is ideal for every food-based artwork. Even within the food materials, every food type has a different behaviour and the context in which they were produced, manufactured and stored have an impact on their behaviour on degradation. Art conservators have thus to consider all those aspects and cooperate with food scientists to understand them.

Conservators are often advised to wait for scientific research before developing conservation methods for artworks and apply specific conservation treatments. It is essential for conservators to figure out in what sense scientific techniques are applicable and, in what sense they could be assessed. Many tried and tested conservation processes, routinely used in the food industry, are inappropriate for maintaining food-based artworks. Preservation methods used by the food industry focus especially on organoleptic and safety factors, which are not always relevant for art conservation. In the art world other limitations exist and these may vary from case to case. Also, food-based art often consists of more than only food materials. Artists used food in installations together with a whole range of other art materials (e.g. Jason Rhoades his French fries together with a Jacuzzi, towels, a motorcycle, an outdoor cooker, etc). Artists treated the food to prolong the shelf life, whether or not in cooperation with conservators (e.g. Robert Gober his donuts). Artists manipulated their food materials (e.g. Zoe Leonards fruit peels with zippers and threads). Especially treated and manipulated food materials give rise to chemical and physical interactions, which may cause yet unknown or only partially documented problems. Although the search for the most feasible and effective conservation strategy can lead conservators in different directions, it is encouraging to have a range of approaches and treatments, for which preservation treatments were monitored.

### 4.3. Efficiency of food preservation techniques: experimental research

The third part of this research focussed on studying food-based artworks. Firstly, a preliminary study of food preservation possibilities for the artworks *Butter and Beeswax* by Joseph Beuys, *Eggs* by Peter De Cupere and *Strange Fruit* by Zoë Leonard, demonstrated that technologies such as MAP and irradiation could be used to store food-based artworks, in order to outline a long-term conservation strategy. By subjecting replicas of those artworks to accelerated ageing, MAP and irradiation could be evaluated for the preservation of these specific artworks and, general conclusions could be made (Advantages and disadvantages: Table 4). Depending on the food products used, one of the technologies could be used.

In the two first cases, it was clear that MAP excluding oxygen could be a valid solution, as MAP slows down the rancidity process of fat containing food products, such as the butter (part of *Butter and beeswax*) and the baked chicken skin (part of *Eggs*). In the case of *Strange Fruit*, containing manipulated fruit peels, it was clear that MAP maintained the colour and structure of the fruit peels. Furthermore, it was demonstrated that MAP protected the 'zipped' banana peel against mould growth. MAP suppressed the bacterial growth, but out of the containment, the microbiological processes will continue to occur. In all cases, it should be noted that when food-based artworks in a MAP environment are taken out of their containment and subjected to normal air conditions degradation process would speed up again. This will result in changes in colour and structure and finally result in decrease of visual quality. In all cases the usefulness to store food-based art in a MAP environment was emphasized during the experimental study.

For the case *Eggs*, MAP and irradiation were tested and evaluated. In this case, it was clear that MAP excluding oxygen could be valid solution as MAP slowed down the rancidity process of the fat on the baked chicken skin and suppressed the bacterial growth. It was evidenced that irradiation increased the amount of peroxides by which oxidative rancidity was noticed in the case *Eggs*. Nevertheless, by irradiating the raw eggs and baked chicken skin in this food-based work the bacterial growth was inhibited, which resulted in a more stable visual quality of that artwork. The combination of MAP and irradiation indicated that the condition of the artwork *Eggs* was stabilized, as the rancidity process increased and, the visual quality of the artwork was maintained. It should also be noted here that once the work is taken out of its containment for

display, degradation would occur again, but because of the irradiation, under slower rates. In order to obtain the best results to preserve such an artwork, *Eggs* should be irradiated and, stored and displayed in a case containing a MAP environment. Definitely, the combination of irradiation and MAP could prolong the life of this artwork. The difference between both techniques is that by applying MAP (during storage or even during display) the extrinsic parameters surrounding the artwork are modified, but the artwork is intrinsically not altered. By irradiating the artwork, it is intrinsically altered, although, this alteration is not visually noticeable. Despite irradiation is conceded as an effective food preservation method, even in the food industry its use is limited, because of consumer acceptance (Prejean 2001).

According to the artists Beuys, De Cupere and Leonard, the studied food-based artworks must be preserved in their ephemerality, in the sense that natural ageing and degradation are part of the concepts of those artworks. The application of MAP and/or irradiation could offer conservators the possibility to stabilize the condition of the artworks *Eggs*, *Butter and beeswax* and *Strange Fruit* during storage and/or display. Although the preliminary study demonstrated that food preservation techniques, such as MAP and irradiation, could help to preserve food-based artworks, the museum professionals at S.M.A.K. and the Philadelphia Museum of art did not apply these approaches for these specific artworks.

This preliminary study on food-based artworks was necessary, as all those food-based artworks contained treated and manipulated food materials, for which the food-industry could only partially rely on tried and tested techniques. Because of the combination of different food-products (e.g. baked chicken skin surrounding raw eggs), food scientists could only rely on preservation methodologies developed for each of the food products. Indeed, the combination of different types of food gave rise to new preservation problems. Without the knowledge that art conservators gathered together on the production of the artworks and, on the environmental conditions in which the works were stored and displayed, it was not possible to develop a conservation methodology.

#### 4.4. Application of food science to food-based artworks: research of cases in their museum context

In the following two chapters of this research it was demonstrated that science effectively plays its role in the preservation of food-based art. It was clear that the results of the experimental laboratory research could not be implemented as such, but it was interesting at that stage to reflect and contextualize these findings and, to assess whether they could feed back into actual conservation practices, or not and, if so, how. Therefore, the following chapters focused on studying the artworks in their museum context. Two cases were analyzed on a theoretical basis and, in two cases food preservation techniques were applied, one during storage and one during display. In order to be able to oversee the main problems and to make evaluations, food scientists, museum professionals, artists and other stakeholders were consulted.

For the food-based artworks, *Untitled* by René Heyvaert and *P.I.G.* by Jason Rhoades, propositions of the application of food preservation techniques were evaluated. In both cases, knowledge about the artwork's production process and how it was preserved by the museum had a considerable impact on the proposed conservation strategies.

For *Untitled*, a work made of bread rolls, the conservation strategy, including reproduction of the bread, was undisputable. Heyvaert stated that his work should be reproduced and, he gave clear instructions on how to do that. After the artist died, the reproduction of this work was done by museum professionals and others respecting Heyvaert's instructions. The visual appearance appeared to be very important. In the case of Heyvaert's bread rolls it was demonstrated that during the reproduction of the breads food production measurements, could be taken in order to improve the reproduction and to prolong its preservation: by adding more salt and/or sugar into the dough and, by adding preservatives, the condition of the bread could be stabilized for a longer period. Furthermore, museum professionals decided to display this work in a Plexiglas display case. It was proposed in this study that such a protective case could be optimized with some small interventions. By using MAP or adding salt inside of the box, the breads will last longer.

For *P.I.G.*, in which French fries were included, two potential conservation strategies were discussed: preservation of the 'original' food materials and reproduction of the food for future installation. In order to understand Jason Rhoades' *P.I.G.* as an artwork made in Ghent, the presence of recognizable French fries appeared to be important. Contextual investigations resulted in those two possible conservation strategies. Food preservation knowledge and techniques can be introduced, in order to improve the preservation of the 'original' French fries and, in order to reproduce French fries that can last longer. The efficiency of storing the French fries in a MAP environment was demonstrated. In order to reproduce French fries that will last longer, different possibilities were given, such as optimal frying conditions in relation to the size and shape of the fries. Although, it is extremely difficult in this case to produce similar French fries that fully adjust to the rules of food preservation, conservators have the choice between two conservation strategies.

In the last part of this PhD study, the application of food preservation techniques in a museum context was discussed. Following the results of the preliminary study on the application of MAP and irradiation for food-based art, museum professionals at S.M.A.K. and at M.I.A.T. (both in Ghent, Belgium) introduced MAP for the preservation of food-based artworks. For these works, storage boxes (based on the one developed for the experiment) and a display case were designed in order to use MAP for their preservation. As evidenced by the storage of *Wirtschaftswerte* and the display of *Autoportrait*, food preservation techniques, based on a MAP environment, can indeed be used to preserve food-based art for the duration of an exposition or, for long-term storage.

The general observation that emerged was that when employing food preservation techniques, the practical input from museum professionals is crucial. They can collaborate with food scientists to help them to find the right preservation solution. Interdisciplinary conversations are required, in which conservators inform the scientists about the production of the artworks and, about the storage and display conditions. In some cases, such as in *Wirtschaftswerte* and *Autoportrait*, not all parameters that are considered in the food industry, such as food safety and food consumption, had to be considered for art conservation. Sensorial properties were more significant.



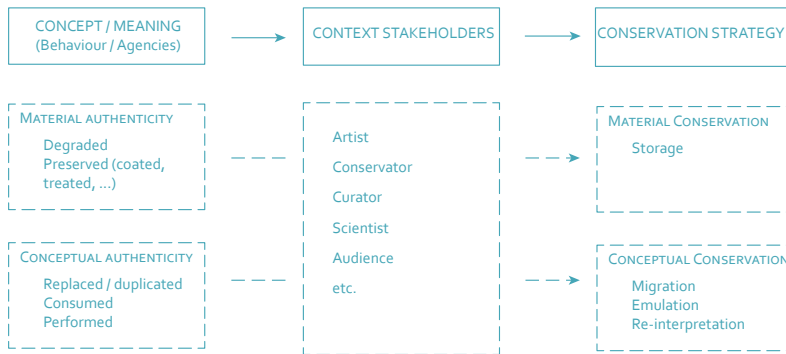


Fig. 97 Framework for the conservation of food-based art: between concept and material

For *Wirtschaftswerte*, it was important that the degradation processes of the visible food products remained. Therefore, museum professionals tried to attempt a compromise between: let the artwork perish during display and, stabilize it into a longer-lasting state by protecting the food against degradation during storage. The non-visible food materials could be replaced according to the artist. Conservators replaced them by less perishable materials. This artwork required a conservation approach in which material and conceptual preservation had to be considered (Figure 97). In the case of the raw cured ham slices by Wim Delvoye, the rancid smell had to be removed and, the visuality of the embroidered cartoons retained. Here, conservators had to think about short-term preservation during the display of the artwork. In both cases  $N_2$  was used to replace  $O_2$ . For *Wirtschaftswerte*, the developed storage boxes appeared to be too big to apply MAP in an optimum manner. It was recommended to use smaller boxes or barrier films for the food-containing packages. For the dry food in this artwork, it was also recommended to add  $CO_2$ , next to the filler  $N_2$ , in the protective atmosphere. For *Autoportrait*, it was demonstrated that the creation of an airtight display case is very important. Minor modifications in the atmosphere, caused by leakage, led to a microbiologically unstable artwork.

#### 4.5. General conclusions and further perspectives

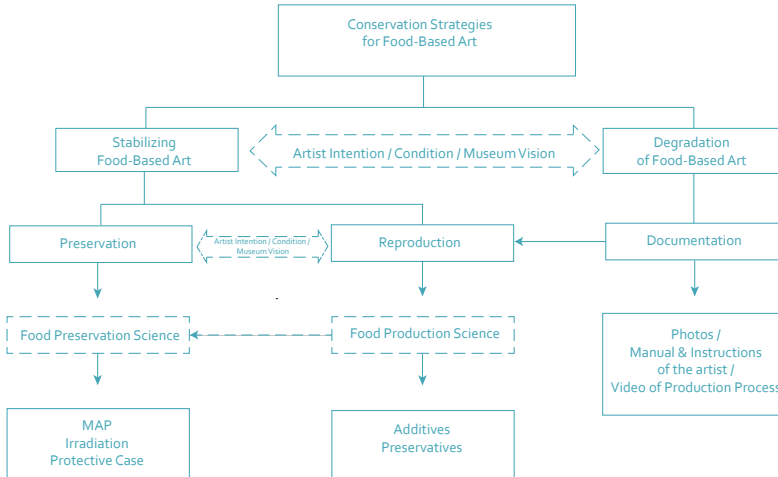


Fig. 98 Conservation strategies for food-based art

By introducing the knowledge of food preservation, it was demonstrated that in all studied cases it is possible to stabilize food-based artworks into a longer-lasting state, as well for artworks in which the food materials had to perform degradation, as for those that had to be reproduced. The success of science-based approaches was exemplified by the useful translation of tested preservation techniques, used in the food industry (Figure 98). Throughout this PhD research, the need for more research dealing with the quantification of food-based art degradation products and the implications for storage and display was evidenced. As different degradation processes could occur in artworks, in which different kinds of food materials are used, each case should be discussed in an interdisciplinary manner with art conservators and food scientists.

The importance of scientific research for the preservation of food-based art was demonstrated through this PhD-study. Also, it was noticed that conservators are uncomfortable with scientific techniques from fields outside the conservation profession. Due to this, and to the lack of knowledge, it appeared that science-based approaches are not always used to their full effectiveness. Facilitating the transfer of the scientific information into practical art conservation knowledge will definitely enhance a greater tolerance for trying the different approaches.

There seem to be a number of avenues of inquiries that could be followed in future years to move this field forward in establishing a framework that would benefit contemporary art conservators. Pursuing research by using a multi-disciplinary approach is necessary for the development of new treatment techniques. The conservation field will highly benefit from incorporating specific knowledge from outside the art conservation field. On top of this, it allows to bring the barriers down between conservation practitioners, other museum professionals and scientific researchers, to their mutual benefit.

Future research on the application of MAP and irradiation in the context of conservation of perishable art and other kinds of contemporary artworks will move this field forward. MAP already proved to be helpful for the preservation of artworks during storage and display, but more applications will make it possible to evaluate what turns out and what not. How can museum professionals improve the application of MAP? Research towards the development of storage and/or display cases in order to facilitate the use of MAP for artworks would be helpful. Which gasses are needed for the different kinds of materials? More experimental research on artworks, containing other materials is necessary, so that the application of MAP can be expanded towards non-food based artworks.

The research concerning the use of irradiation as a preservation technique for artworks can certainly be expanded. Firstly, more tolerance is needed, as it was proved that this technique could stabilize the visual quality of food-based artworks. Scientific research in the food industry demonstrated that irradiated food could have a longer shelf-life than non-irradiated food. Also, by irradiation food materials could last longer while appearing 'fresh', even if it could be inferior in nutrition and taste. Thus, for artworks that are not concerned with consumption it is definitely interesting to do more quantified research on irradiation. Further research on the radiation doses and the effects on the long-term for different art materials would be helpful. Depending on the absorbed radiation dose, various effects can be achieved resulting in reduced storage losses, extended shelf life and/or improved microbiological safety.

The use of MAP and irradiation are science-based approaches that contribute to the search for a compromise between the preservation and decay of perishable artworks. Increasing the application of such scientific techniques will contribute to the establishment of science in contemporary art conservation. Another prerequisite for successfully taking up the challenges posed by the conservation and management of

contemporary art and the role conservation science can play therein, is long term monitoring of the effectiveness of the techniques. Sufficient documentation on the techniques themselves, the way they should be applied and, what the consequences of their use are, should all be gathered in evaluation reports. For instance, developing templates with some kind of standardisation, thus making a comparison across the very different types of strategies possible (such as Figure 98), will promote greater inclusivity and ensure more effective integration between different branches of science, and between science and practice.

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