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Universität für angewandte Kunst Wien
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CAUSES OF TEXTILE DAMAGES AND CONSERVATION ISSUES

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Textiles are among the most sensitive objects in museum collections due to their organic nature.

Their long-term preservation is affected by numerous agents of deterioration, including light, incorrect temperature,

incorrect relative humidity (RH), pollutants, pests and physical forces.

This lecture should give you an understanding about the influence of damaging factors to textile items of museums collections.

I will show you some pictures of textiles damaged by these harmful situations and at least I will give you methods and practical approaches to avoid such damages on textiles and to avoid bad situations by manipulation with textiles.

This theoretical knowledge should help us by practical work during the next days.

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introduction

TYPES OF TEXTILES:

- plant fibres (cotton, linen, bast)
- animal fibres (silk, wool)

- synthetic fibres

Historically, textiles were made from natural materials such as plant and animal fibres, whilst synthetic fibres were developed and used in textiles from the late 19th century.

The most common plant fibres are cotton, linen and bast (made from the stem of plants such as hemp), whilst the most common animal fibres are silk and wool.

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introduction

PROPERTIES OF A TEXTILE,
depending on:

- chemical and physical properties of the fibres
- qualities of spun yarns
- woven structure of the fabric
- cut of the fabric
- use of the fabric

All types of fibres are processed and then spun to make yarn. In spun yarns, the tightness of the spinn and the number of plies produces typical qualities. The yarn is knitted or woven to make fabric.

The chemical and physical properties of the fibre,

how the yarn was prepared,

the woven structure of the fabric and

how it was cut and used

will determine the properties of a textile, how it will withstand use and how it will deteriorate.

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textile damages

- creases
- distortion
- brittleness
- breakage
- tears
- cuts
- holes
- losses
- insect damages
- mould

- discolouration
- fading
- yellowing
- splits
- stains
- rust stains
- foxing

creases (Falten)
distortion (Verformung)
brittleness (Brüchigkeit)
breakage (Bruch)

tears (Risse)
cuts (Schnitte)
holes (Löcher)
losses (Verlust/Ausfall)

discolouration (Farbveränderung)
fading (Ausbleichen)
yellowing (Vergilben)
splits (Spritzer)
stains (Flecken)
rust stains (Rostflecken)
foxing (Stockflecken)

insect damages

mould (Schimmel)
foxing (Stockflecken)

slack canvas (Leinwand hängt durch)
yellowed varnish (verbräunter Firniss)
breakage (Bruch, Bruchstelle, Querriss)
accretions (Ab-/Anlagerung)
flaking paint/ink (Farbe/Tinte löst sich ab)

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internal

DAMAGE FACTORS,
internal problems caused by:

- materials found on textiles
  i.e. beads on silk dress
- the properties of the fibres
  i.e. synthetic fibres
- manufacturing processes
  i.e. tin-weighted silks, iron salts to fix black dyes

Some problems in textiles are internal and are caused by the properties of the fibres themselves.

Many synthetic fibres are chemically unstable and discolour, degrade or simply fall apart as they age. Exposure to light will accelarate these problems.

Other internal problems are caused by manufacturing processes. Silk, for example, was artificially „weighted“ in the late 19th and early 20th centuries.

Weighting involved chemically bonding metal salts to the fabric. It made the silk rustle and gave an impression of quality and luxury. Weighting could be used on a high quality silk, or to make a cheaper silk appear more expensive. As silk was often sold by weight, some manufacturers would deliberately overweight their silk in order to increase their profits.

The tin salts used in the late 19th and early 20th century for weighting cause problems. Tin salts, and the process to apply them, attack the fibres, weaking them and making them more easily damaged by acids, alkalis, hight temperatures and light. Tin-weighted silks are likely to be very fragile and prone to „rotting“ or ahattering and may disintegrate if handled carelessly. Because the weighting is chemicallybound to the fabric and cannot be removed, the problem is inherent to the textile.

Another inherent problem with historic textiles comes from the use of iron salts to fix black dyes. Before the introduction of synthetic dyes in the mid 19th century, it was very difficult to produce a dense black for fabrics and yarns.

Metal salts were used as a fixative (also called a mordant) and to chemically modify the colour of a natural dye. One such mordant was based on iron, which gave a rich dense black. Over time, the iron salts attack the fibres themselves, weaking them to such an extent that they eventually turn to dust. As with tin weighting, iron mordants are chemically bound to the textile fibres and connot be removed.

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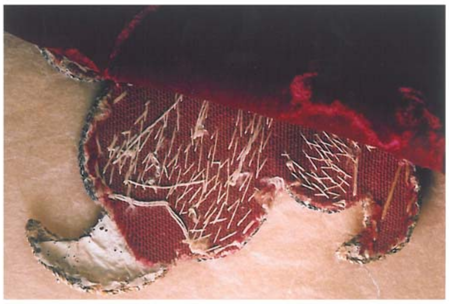
cut off/remounted

Wappenrock, 17th century

embroidery has been cut off and remounted



Cutting up textiles to use them in a different way is a common remedy; particularly when the ground fabric of the original textile is in a sad state. Damaged tapestries have been cut up to make cushions, whilst embroidered dragons from Chinese silks are sometimes mounted for display. After all, this is simply a way of extending the use of an attractive but worn out textile.

Many historically important textiles have been damaged or lost in recent times, for example embroidered altar frontals where embroidery has been cut off and remounted, destroying the integrity and value of the original textile.

Beispiel: Kaiserliche Schatzkammer Wien, Wappenrock für den Herold des Königs von Böhmen, 17. Jh., Inv.-Nr.: SK_WS_XIV 63

Material: Samt, Lampaslampé, Gold-, Silber- und Seidenstickerei, Fransenborte, Glas

Aufbau der Stickerei: Der gekrönte steigende Löwe wurde separat gearbeitet. Er ist in erhöhter Legetechnik ausgeführt: Dabei wurden über eine plastisch gearbeitete, mit Stoff überzogene Unterlage Metallfäden gelegt und darauf fixiert. Die Rückseite dieser Stickerei ist verleimt und mit Papier beklebt. **Das Motiv wurde anschließend auf einen roten Lamé genäht, zu einem späteren Zeitpunkt jedoch ausgeschnitten und auf**

den jetzigen Grundstoff des Wappenrocks (Samt) appliziert. Rest des originalen Lamé sind auf der Rückseite der Stickerei noch erhalten.
Zwischen Oberstoff (Samt) und Futter des Wappenrockes ist ein „Stützfutter“ aus Leinen eingefügt, das ältere Nahtspuren aufweist. Diese zeichnen in seitenverkehrter Spiegelung das Löwenmotiv nach.

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mixed media

Charleston dress, 1928

weight of beads caused tears on the net dress

A wide range of materials, such as metals, wood, glass, plastics, leather, fur or feathers may be found in or on historic textiles an can complicate cleaning, care and storage.

In some cases the problems with these materials can affect the life of the textile as a whole, for example the weight of beads on a net dress can cause tears as the net ages and becomes more fragile.

Beispiel: Charleston Kleid, 1928, Kostüm- und Modesammlung;

Many synthetic fibres are chemically unstable and discolour, degrade or simply fall apart as they age. Exposure to light will accelarate these problems.

Beispiel: Kunstlederstiefel, 1972, Wien Museum; Diplomarbeit: Sophie Kurzmann

Material: Polyamid (Futter, schwarzer Knautschlackträgerstoff, Nähfäden), Polyurethan (Knautschlackbeschichtung, Sohlenmaterial)
Ausblühungen: Adipinsäure, diese ist ein Grundstoff bei der Herstellung von flexiblem Polyurethan speziell für Schuhsohlen

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synthetics

bathing cap, 20th century

Many synthetic fibres are chemically unstable and discolour, degrade or simply fall apart as they age. Exposure to light will accelarate these problems.

Beispiel: Badehauben, 20. Jh., Joanneum Graz; Folienprojekt

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tin-weighted silks


umbrella, 1830

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Beispiel: Schirm, 1830, Vorarlberger Museum; Diplomarbeit: Leonie Tscherner

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Beispiel: Kaiserliche Schatzkammer Wien, Krönungsmantel, Palermo/Königliche Hofwerkstätten, 1133/1134, Inv.-Nr.: SK_WS_XIII14

Reste dunkelblauer Stickfäden, ursprünglich wurde jede Perlenreihe u/o goldgestickte Fläche von einer dunklen Linie gerahmt.

Der Krönungsmantel

Künstler: Palermo, Königliche Hofwerkstätten

Palermo
1133/1134

Textil; liturgisches Gewand; Krönungsornat

Textil; Gemusterter Samit (Kermesfärbung), Gold- und Seidenstickerei, Perlen, Gold mit Zellenschmelzemail, Rubin, Spinelle, Saphire, Granate, Glas, Brettchengewebe

H. 146 cm, B. 345 cm

Inschrift:
Kufi-Inschrift (Übersetzung): (Das ist) von dem, was in der königlichen Kammer (Hofwerkstatt) angefertigt wurde, (welche) gediehen ist mit Glück und Ehre, mit Eifer und Vollkommenheit, mit Macht und Verdienst, mit (Seiner) Zustimmung und (Seinem) Wohlergehen, mit Großmut und Erhabenheit, mit Ruhm und Schönheit sowie der Erfüllung der Wünsche und Hoffnungen und mit glücklichen Tagen und Nächten ohne Unterlaß und ohne Änderung, mit Ehre und Fürsorge, mit Wahrung und Schutz, mit Erfolg und Sicherheit, mit Triumph und Tüchtigkeit. In der (Haupt)stadt Siziliens im Jahre 528

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environmental

DAMAGE FACTORS,
environmental problems caused by:

- light
- temperature and relative humidity
- dust and dirt
- air pollution
- pests
- improper manipulation
- improper storage or display

Textiles that are displayed are subject to deterioration by many environmental factors – such as

- light
- temperature and relative humidity
- dust and dirt
- air pollution
- pests
- improper handling
- and improper storage or display

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maintaining

MAINTAINING FACTORS:

- control of environmental conditions
- proper manipulation
- proper storage
- proper display techniques

PROVIDE BEST CONDITION POSSIBLE!

Thus the critical factors in maintaining your textile collection are

- control of environmental conditions
- proper handling
- proper storage
- and proper display techniques

Understandably, *the standards museums strive for are not feasible in the home,* but modifications can be made in order to provide the best condition possible.

These guidelines serve as an introduction and checklist for the care of textiles in the home.

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light

DAMAGE EFFECTS: LIGHT

- textiles dyes will fade or change
- yellowing of plant fibres (cotton, linen, bast)
- fibres become brittle
- shrinkage/cracking

One of the greatest threats to textiles is light.

The worst damage is caused by ultraviolet (UV) radiation from natural daylight and from fluorescent light bulbs.

However, while the UV rays damage most rapidly, the entire light spectrum causes textiles dyes to fade and the fibres to become brittle. This includes plain incandescent interior lighting.

IR radiation leads to both, mechanical effects (shrinkage and cracking) and chemical reactions (faster degradation of cellulose, e.g.).

Textiles and the dyestuffs of fabrics or threads are **extremely sensitive to light**.

Light sources in museum, e.g. sunlight, incandescent light bulbs discharge lamps

Visible light, as well as **invisible infrared and ultraviolet radiation**, can cause **irreversible** damage.

Light sets off **chemical changes**, which weaken and/or discolour textiles.

Any exposure to light even at the most restricted level will cause **cumulative damage**.

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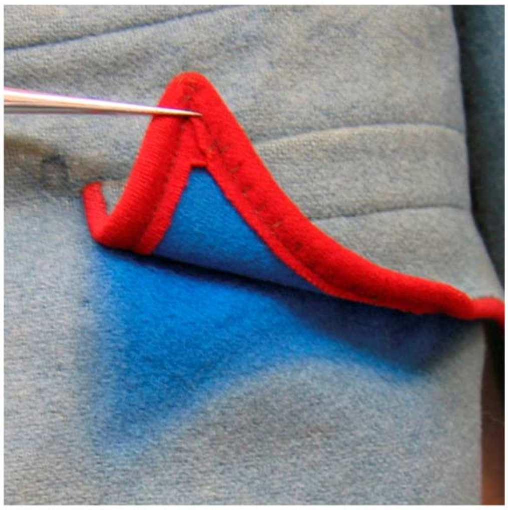
fading



military uniform, 19th century

Uniform, 19th century. At the first few you can not see that the item is damaged by light, but if you look under the pocket you see the colour is faded.

Beispiel: Militäruniform, 19. Jh., Kultur- und Betriebsgesellschaft Schloss Schönbrunn

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yellowing

gloves, 19th century

Beispiel: Handschuhe, 19. Jh., Waidhofen an der Thaya

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brittleness

dress, 19th century

Beispiel: Kleid, 19. Jh., Waidhofen an der Thaya di:'ʌngewʌndtə.conservation

light

HOW TO AVOID DAMAGES CAUSED BY LIGHT?
→ Reducing illumination at the surface

- no direct sunglight
- blinds and shutters
- old-fashioned curtains
- UV filtering materials

There is some protection in keeping window shades pulled down or shutters closed during the sunniest times of the day.

UV filtering materials or films can be placed over windows and fluorescent bulbs, and used in the glass or Plexiglas framing textiles.

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light

HOW TO AVOID DAMAGES CAUSED BY LIGHT?
→ Shortening time span of exposure

- length of exhibition
- rotation of objects during the exhibition
- fixed numbers of lux hours
- light sensors linked to shades, blinds, light sources etc.

Perhaps the most important rule of thumb is taking care to display your textile for limited periods of time.

Ideally, rotation should be done seasonnally – display your textile for three months, and then allow it to „rest“ in proper storage for the rest of the year. This method of care allows several different textiles to be exhibited, while extending the lifetime of each one.

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light

HOW TO AVOID DAMAGES CAUSED BY LIGHT?
→ Controlling measurements

- measuring the light levels
- length of exhibition (lux hours)
- measuring UV rays

Pocket Line testo 540

Objects on display made from light-sensitive materials should be exposed to minimum lighting conditions only during the openingn hours of a museum and for a restricted number of days; for example, an exposeure of 50 lux for 125 days at eight hours a day results in 50.000 lux-hours per year. Objects made from materials that are less light-sensitive may be exposed for 480.000 lux-hours per year (200 lux x 200 days x 8 hours per day).

Beispiele: Beleuchtungsstärke-Messgerät im Taschenformat, Pocket Line testo 540

UV-Messgerät, Gröbel RM 12

<u>Lichtmessgeräte</u>

Luxmessgeräte sind bezüglich ihrer Qualität oft nur sehr schwer vergleichbar. Die Genauigkeit ist häufig nur für bestimmte Testkriterien (z.B. Glühlampenlicht, bestimmter Winkel etc.) angegeben, wobei jeder Hersteller andere Kriterien angibt. Der einzig zuverlässige Qualitätsnachweis ist die Klassifizierung nach DIN 5032 Teil 7, wobei 16 Kriterien untersucht werden. Bei Klasse B liegt der nach einer bestimmten Formel errechnete Gesamtfehler bei max. 10%, bei Klasse C bei max. 20%. Für die 16 Testkriterien gilt jeweils ein Maximalwert. Eine ganz andere Frage ist, welche Genauigkeit im Museum benötigt wird. Wie auf der Didaktikseite ausgeführt, gibt die Messung der Beleuchtungsstärke (lx) nur sehr eingeschränkt Auskunft über das Schädigungspotential des Lichts. Mindestens ebenso wichtig ist die Frage, welchen Blauanteil das Licht enthält. Auch der UV-Anteil wird bei der Luxmessung nicht berücksichtigt. (Ein UV-Messgerät ist daher letztendlich unverzichtbar, wenn es darum geht, Lichtschäden zu minimieren). In der Literatur wird Genauigkeitsklasse B als für Museen angestrebt. Aus den oben genannten Gründen lässt sich jedoch fragen, ob bei der Luxmessung im Museum die hohe Genauigkeit immer der entscheidende Faktor ist. Sicher sollten Luxmessgeräte jedoch auch nicht völlig ungenau sein, nicht zuletzt damit die Messungen zwischen den einzelnen Museen und mit verschiedenen Geräten vergleichbar bleiben. Letztendlich muss jeder Anwender selbst die für ihn beste Lösung wählen.

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climate

DAMAGE EFFECTS: TEMPERATURE

- physical processes
- chemical processes
- biological processes

Temperature

Physical processes: Depending on the material, the objects expand when they warm up and shrink when they cool down. No change of their chemical structure.

Chemical processes: High temperatures increase the speed of chemical reactions. Change of chemical composition.

Biological processes: Certain temperature levels can lead to growth of living organisms (insects, fungi) and cause damage of organic materials.

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climate

DAMAGE FACTORS: RELATIVE HUMIDITY

- high RH
- low RH
- fluctuating RH

High RH (> 55 %)

•Accelerates photochemical reactions.

•Enhances fungal growth (in particular in combination with high temperature).

•Causes rapid metal corrosion.

•Textiles fade more quickly.

•Textiles absorb so much moisture that they will deform and break under there own weight.

•Protein fibres break down into their components at an RH of 60 % → which leads to “gelatinisation” of leather.

Low RH (< 45 %)

•Embrittlement of organic materials (e.g. vegetable and animal adhesives)

•Loss of flexibility and elasticity

Fluctuating RH

•Causes abrasion between fibres and threads, leading to tension and therefore to rapid decay.

•Rapid fluctuations over hours will have little effect, if the RH returns to the original conditions.

•A rapid change leading to new RH conditions is very damaging.

•Particularly damaging to objects composed of different materials.

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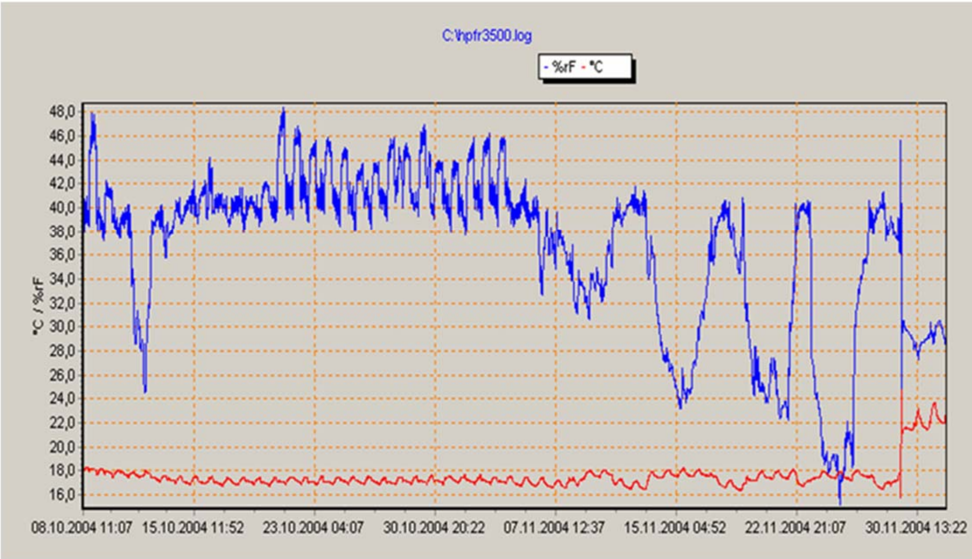
fluctuating RH



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mould

uniform hat, 19th century


excavation found, 17th century

Beispiele:

Zweispitz in Original-Karton, 19. Jh., Sammlung Wagenburg/Monturdepot

St. Stephan, Katakomben, Juli 2005

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foxing

cotton mounts with foxing

Fungal growths → applied on the surface of a material black, blue, green, red and whitish spots. The material will be discolour and damage the structure of the material.

Fungi are capable digesting cellulose, therefore objects made from vegetable fibres are especially vulnerable to attack.

Synthetic fibres are generally not affected by fungi, unless they are soild or have certain finish.

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distortion

plate (leather), 16th century

gloves (leather), 1865

Beispiele:

sog. Lederteller, 1. Hälfte 16. Jh., Schloss Ambrass; Vordiplom: Sophie Kurzmann

Lederhandschuhe zur Uniform der Trabantenleibgarde, ehemals im Besitz von Kronprinz Rudolf, um 1865, Kultur- und Betriebsgesellschaft Schloss Schönbrunn; Semesterprojekt: Hanna Grabner dı:'ʌngewʌndte.conservation

climate

HOW TO AVOID DAMAGES CAUSED BY CLIMATE?
→ Monitoring the environment

- thermohydrograph
- data loggers

Rotronic HygroLoc D

Datenlogger

Datenlogger führen in bestimmten Zeitabständen Sensormessungen durch und speichern die Messergebnisse im internen Speicher. Zur Kontrolle der Klimabedingungen in Transportkisten haben sich kleine Datenlogger bewährt. Gilt es nur zu überwachen, ob Grenzwerte nach oben überschritten wurden, können im übrigen auch irreversible Temperaturmessfolien (z.B. Omega) oder irreversible Feuchteindikatorstreifen verwendet werden. Dem gegenüber haben Datenlogger den Vorzug, den gesamten Klimaverlauf zu dokumentieren. Sie sind jedoch auch für Klimamessungen in Vitrinen oder Räumen geeignet.
Die Vielzahl der angebotenen Produkte und Sonderfunktionen ist atemberaubend. Die wichtigsten Unterscheidungsmerkmale sind im folgenden aufgeführt. Daneben gibt es für spezielle Anwendungen noch eine Vielzahl Zusatzfunktionen. Auf Anfrage beraten wir Sie gerne.

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climate

Elces 764

multiple measuring instrument

- Relative Humidity (RH)
- Temperature (T)
- Visible Light (Vs)
- UV-Light (UV)

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climate

HOW TO AVOID DAMAGES CAUSED BY CLIMATE?
→ Conditioning of the environment

- ventilation/air-condition systems
- heating and cooling elements
- humidifiers and dehumidifiers
- passive buffer (buffering material such as tissue/cardboard)
- division into critical and non-critical zones
- placing sensitive objects into show cases
- chemical substances to humidify/dehumidify

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pollutants

pollutants=gases, aerosols, liquids, solids of anthropogenic or natural origin

pollutants=deposits of solid particles

How can pollutants reach the objects and cause deterioration?

- airborne
- transferred by contact
- intrinsic

Pollutants are grouped into a range of compounds that can have chemical reactions with any component of an object.

Pollutants can be gases, aerosols, liquids or solids of either anthropogenic or natural origin, and they are substances that are known to have negative consequences on objects.

Deposits of solid particles are considered pollutants, and while they may not necessarily cause damage, they are recognized as altering the aesthetic aspects of the objects. In some cases, fine particles deposited on an object's surface can be strongly bonded.

In a museum, there are three modes of action for pollutants to reach objects and cause deterioration.

In the first mode, the pollutants are airborne;

In the second, the pollutants are transferred between two materials at points of contact;

as for the third, it is intrinsic, in that the pollutant already exists, as part of the material composing the object, or is formed during chemical reactions on or within it.

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pollutants

SOURCES OF POLLUTANTS:

Gases:
- industrial, vehicle and other emissions
- products within in the museum (i.e. wood, coatings, acidic tissue paper, historic objects)
- deterioration of the fibre itself
- manufacturing, finishing processes

Solid particles:
- dust
- soils (environment, water/food stains, improper handling)

Gases resulting from industrial, vehicle, and other emissions cause degradative chemical reactions, which affect fibre properties.

Some products within the museum such as wood, coatings, acidic tissue paper, and other historic objects can emit harmful gases.

Acidity of fibres can also result from the deterioration of the fibre itself and from manufacturing and finishing processes.

Solid particles, such as dust from clothing and soil from the immediate environment, are harmful because they can become trapped in the spaces within and between threads, and on irregular fibre surfaces.

The most harmful air pollutants are the acidic and oxidising gases sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), the reducing gas formaldehyde (HCHO), ozone (O_3) and fine dusts, such as soot and metal (oxide) particles. Examples of sources of pollution inside a museum include:

Acids: cleaning agents, wood and boards → accelerates the decay of organic materials.

Hydrogen sulphide: rotting of organic material (e.g. leather → „red rot“), substances containing sulphur may emit hydrogen sulphide.

Nitrogen dioxide: internal combustion engines, gas-fired appliances (water heaters and cooking equipment).

Formaldehyde: chipboard and some medium density fibreboard (MDF) → accelerates the decay of organic materials.

Ozone and Soot (toner): electrostatic copy machines, printers → accelerates the oxidation of organic materials.

Soot, tar: smoke from cigarettes → colour changes, loss of flexibility (silk).

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pollutants

DAMAGE EFFECTS: POLLUTANTS

- altering aesthetic aspects of the objects
- mechanical damages, particles can cut through fibres when manipulated
- degradative chemical reactions of fibres/dyes especially under high humidity

→ disfigurement, weakening, breakage

- food sources for mould, insects

Sharp, gritty particles of silica, commonly found in dust, can cut through fibres when handled during storage, display, or transit.

At higher temperatures and RH, fine dust will cement itself to fibres within a short period and become very difficult to remove.

Some particulates absorb pollutants from the environment, which may lead to a harmful chemical reaction to the fibre or the dye under high humidity.

Some soils are food sources for mould, insects, and other damaging biological activity.

Oils deposited from improper handling, water and food stains, and soils from use can oxidize and become set over time, causing disfigurement, weakening, and breakage.

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dust

cleaning/vacuuming

wall hanging, 19th century

fan, 19th century

Beispiele: dust

Wandbehang, 19. Jh., Haintz

Fächer, 19. Jh., Waidhofen an der Thaya

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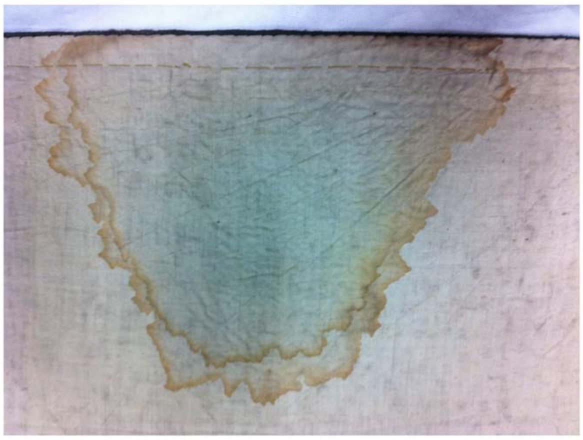
soot/stains

soot caused by fire

shirt, 20th century

stain caused by damaged water pipe



tapestry (backside), 18th century

Beispiele:
soot, shirt, 20. Jh., Sammlung Helmut Lang
water stain, tapestry

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improper handling

hand print on the surface of a silver thread fabric

paravent, 20th century

Oils deposited from improper handling, water and food stains, and soils from use **can oxidize and become set over time, causing disfigurement, weakening, and breakage.**

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pollutants

HOW TO AVOID POLLUTANTS?
→ minimize atmospheric pollutants

- keep windows/doors closed, seal openings
- good housekeeping, cleaning
- proper ventilation/filtering of recirculated air
- cover objects when not being used
- use recommended products
- use barriers and pollution absorbers
- store chemicals/cleaning agents separately

Keep windows and doors closed to minimize problems due to atmospheric pollutants. Any openings to the exterior should be properly sealed.

Good housekeeping cannot be overstressed in preventive conservation. Every museum should practice a routine of thorough, methodical inspection and meticulous cleaning. The cleaner the storage and display area, the less chance there is of mould, insects, chemical damage, and abrasion occurring.

•*Proper ventilation of storage facilities in order to reduce pollution.*

•*Proper filtering of recirculated air.*

Objects can be protected from light and dust by covering them temporarily when they are not being used.

Atmospheric pollutants within the museum can be controlled to some extent by using recommended products, e.g. stable paints on walls and carpeting that does not emit harmful gases. Mounts used to support artifacts in storage and on display should be constructed from stable materials.

Acid free boxes for packaging/storage.

In doubt use barriers and pollution absorbers.

Chemicals such as paints and cleaning agents should be stored in a space away from collection storage or display.

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pests

pests=insects, rodents, birds, fungi

insects: need proteins contained in materials such as wool, silk, feathers, leather (i.e. cloth moth, carpet beetle, fur beetle, flour beetle)

rodents: need textiles for nest-building (i.e. mice, rats)

birds: are host animals for insects; nest building in storage facilities

Many materials housed in museums are vulnerable to deterioration by insects, fungi, rodents or birds.

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birds: are host animals for insects; nest building in storage facilities

fungi: live on the surface of materials; capable of digesting cellulose→plant fibres especially vulnerable to be attacked

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pests

DAMAGE EFFECTS: PESTS
- insects (dead or alive) at various stages of ist development
- parts of insect (wings, casing)
- frass dropping
- damaged areas on the artifact
- loss of fibres and hair
- chewed feathers and guilts
- perforated skins
- grazed nap on fabrics
- holes in surfaces

While a few insects found among many artifacts may not incite great concern, certain conditions allow pests to progress from grazing and perforation to complete destruction of artifacts.

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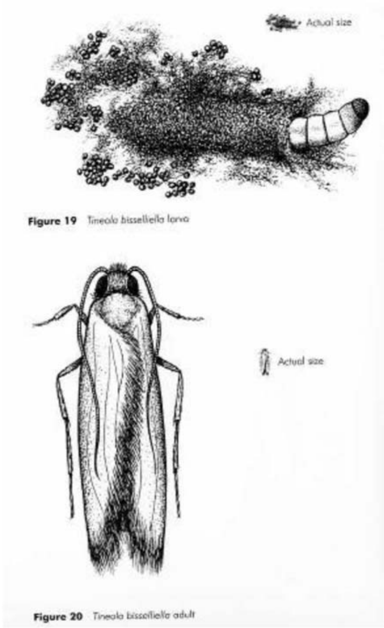
clothes moths



The following examples will show you textile damages caused by pests.

Beispiel: Interior (wool) of a carriage, 19th century, Sammlung Wagenburg/Monturdepot

Infestation of clothes moths, indicated by webbing, cocoons, faceal pellets.

Insects eggs are hard to see with the naked eye.

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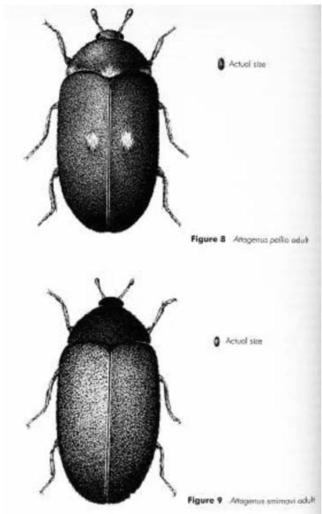
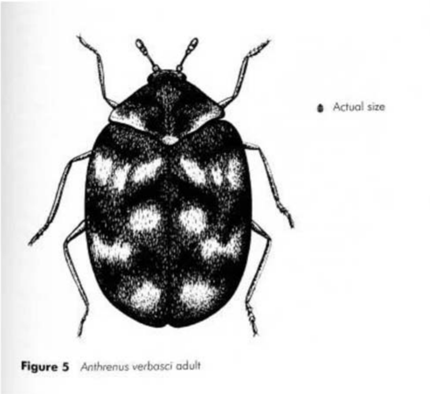
carpet beetle



Infestation of carpet beetle. Damge effects: Loss of fibres, holes

fur beetle



icebear, 19th century

Infestation of fur beetle. Damage effects: loss of hair

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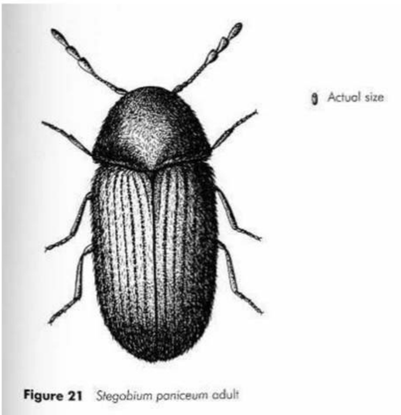
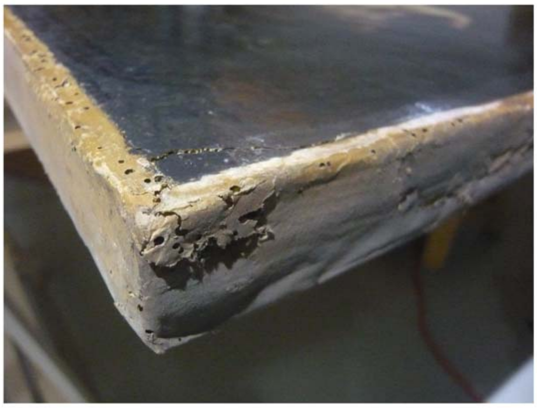
flour beetle





painting fixed with starch paste

Infestation of flour beetle. Damage effects:

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rodents (mice)

mouse nest on a coat

Beispiele: coat made of wool damaged by mice

Damage caused by rodents and birds → holes, tears, excrements, stains, food leftovers.

indicated by

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birds

droppings on a silk document

Beispiel: bird‘s excrements on a textile document (silk)

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pests

SOURCES OF INFESTATION:

- buildings
- staff/visitors
- host animals
- loans
- packing material
- equipment
- merchandise

Pests can enter buildings by boring holes or through existing ones.

Pests enter a museum through open windows, air vents, sewers, and through poorly sealed windows, doors, and walls. Deterioration of the building allows water to penetrate the structure, causing dampness, fungal decay of wood and paint, and subsequent attack by insects.

Accumulated dirt, dust, and hair from careless housekeeping; foodstuffs introduced to storage or exhibit areas; and animal nests and corpses in eaves, attics, and walls all provide ideal breeding and survival conditions for insects and rodents

They can also be carried in by staff and enter on objects on loan, on equipment or merchandise. New acquisitions, incoming loans, and objects returned to the collection after loan to another institution sometimes carry pests. Packaging materials such as corrugated cardboard or felt are also potential harbourages of infestation.

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pests

CONTROLLING AGENTS OF DETERIORATION:

- avoid
- block
- detect
- respond
- recover/treat

Controlling agents of deterioration

Detection is an integral part of the ideal approach to controlling agents of deterioration, which involves five stages:

1. Avoid: Reduce the attractants that invited the infestation or the increase in pest numbers. For example: improve sanitation; organize or discard clutter.
2. Block: Reduce further problems by isolating the artifact, case, or room. For example: bag objects or use tape to seal leaky cabinet doors. Screen off ventilator outlets. Control the flow of objects in and out of the area. Inspect surrounding areas to determine the extent of the infestation and to locate ist source.
3. Detect: Take measures to determine if there are pests present. For example: Collect specimen. Inspect the object or set it over white paper to reveal frass dropping from active infestation.
4. Respond: If there is an infestation, apply appropriate control methods to the collection and the collection area. For example: increased sanitation, cleaning of artifacts, low or high temperature exposure, controlled atmosphere fumigation, or pesticide application. Assess control measures by continuing practices.
5. Recover/treat: Clean affected artifacts to prevent false alarms on later

inspections. Perform necessary consolidatory and restorative measures.

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pests

HOW TO AVOID PESTS?

- good housekeeping, building maintenance
- regularly cleaning
- no beverages/foodstuff
- quarantine of new acquisitions
- examination of textiles
- monitoring for infestation

Good building design and maintenance reduce the former, while quarantine, inspection, and treatment of artifacts reduce the latter.

Keep the exterior walls of the building free from plantings to reduce pest habitat and allow easy inspection of the building fabric.

Minimize clutter and ensure that the rooms are cleaned periodically to prevent it from becoming a source of infestation.

Avoid using, storing, or leaving beverages or foodstuffs in display and collection storage rooms.

All new acquisitions and loans should be quarantined, examined, and monitored before being introduced into the collection. This allows staff to detect mould and insects.

Examine textiles, clothing, and accessoires front and back; inside and out; in pockets, folds and sleeves; under collars; along seams; under appliqué, bindings, buttons, hems, linings, and padding; and in all hidden areas where insects might live.

To inspect skins and furs, look along seams and part the fur with your fingers to inspect the skin. While one may not be able to examine all of a fur or a complicated textile, these inspections often reveal signs of insect attacks.

Upholstered furniture and stuffed animals are often present intractable inspection problems because insects may breed and live in the interior, although active larvae and adults are often seen on the surface. Keratinous stuffing (hiar, wool) is more likely to be infested by insects than cellulosic stuffing (cotton, kapok).

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monitoring

adhesive trap

pheromone traps

Monitoring for infestation

Use adhesive traps and pheromone traps, to routinely monitor the collection, display, and support areas of museum facilities.

Adhesive traps are covered with a cardboard shelter that attracts insects to crawl inside and that protects the adhesive from falling debris. The adhesive on these traps is active for only a couple of months.

Pheromone traps are designed specifically for one insect species, or for a few closely related species at best. These traps can combine sex attractants and food attractants to detect both male and female adult insects.

Replace traps regularly, ideally on a monthly inspection. Otherwise, as insects accumulate on old traps, they become bait and ultimately food for damaging dermestid beetles, which multiply and leave the inactive trap to infest nearby areas.

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monitoring

light trap

mechanical trap

Light traps attract many flying adult insects. The light sources are often rich in ultraviolet radiation, so do not place them where they can irradiate artifacts in the collection.

Mechanical traps are useful to detect and control rodent infestations.

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Universität für angewandte Kunst Wien
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THANK YOU FOR LISTENING!

MA **Tanja** Kimmel

Textile-Workshop, Bogd Khan Palace Museum, Feb. 24-28, 2014

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To avoid damage effects caused by display my colleagues will show you proper techniques in her lecture.