

Linguistische Modellierung multimodaler Dokumente



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Multisemiose und intersemiotische Relationen in multimodalen Dokumenten

Sabine Bartsch

Technische Universität Darmstadt

Institut für Sprach- und Literaturwissenschaft

URL: <http://www.linglit.tu-darmstadt.de>

E-Mail: bartsch@linglit.tu-darmstadt.de

- Forschungskontext
- Einleitung Multimodalität
 - Multimodale Dokumente
 - Forschungsdesiderate
- Theorie
 - Registertheorie
 - Multimodale Diskursanalyse
- Methoden
 - Multimodale Corpora
 - Annotation
 - Analyse
- Zusammenfassung



-
- Fachliche Register (languages for special purposes (LSP)) und Wissenschaftssprache (languages for academic purposes (LAP))
 - Technisches Vokabular, Terminologie
 - Domänenspezifische Kollokationen
 - Lexikogrammatische Phänomene:
Nominalisierung, grammatische Metapher etc.
 - Haltung *stance*, *hedging*-Phänomene (Biber 2004; Hyland 1988)
 - Selbstkonstruktion des Wissenschaftlers in wissenschaftlichen Texten



- Linguistische Konstruktion von Wissen und deren Veränderung im Verlaufe der historischen Entwicklung der Wissenschaften (cf. Halliday 1988; Halliday & Martin 1993; O'Halloran 1999; 2004; 2006)
- Untersuchungen zu natur- und ingenieurwissenschaftlichen Registern an der TU Darmstadt (Bartsch 2004; Bartsch et al. 2005; DFG Projekt Linguistische Profile interdisziplinärer Register)



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- **Registerlinguistik** (Halliday & Hasan 1989; Biber et al. 1995; Martin 1985)
 - **Systemisch Funktionale Grammatik (SFG)** (Halliday 2004)
 - **Multimodale Diskursanalyse (MDA)** (O'Halloran 2004; 2006)



- **Generierung**
(McKeown 1985; Bateman 1990; Bateman et al. 2001)
- **Multimodale und multimediale Dokumente**
(Mani, Maybury 1999; Matthiessen, Kobayashi, Licheng, 1995; André, Rist 1994; Kress & van Leeuwen 2001)
- **Multimodale Domäne Mathematik**
(O'Halloran 1999)
- **GeM (Genre and Multimodality)**
(Bateman et al. 2002)



- Zentrale Aspekte wissenschaftlicher und akademischer Texte werden bislang weitgehend ignoriert:
 - Visuelle Artefakte wie Bilder, schematische Darstellungen, CAD-Modelle etc.
 - Symbolische Repräsentationen (Formeln etc.)
 - Interaktion zwischen semiotischen Ressourcen
 - Textuelle Organisation (Diskursstruktur)
- Selbstdarstellung eines Maschinenbauingenieurs:
„die Zeichnung ist die Sprache des Ingenieurs“

Forschungsgegenstand

Multimodalität in Natur- und Ingenieurwissenschaften



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3 Rapid Prototyping Techniques

Most commercially available rapid prototyping machines use one of six techniques. At present, trade restrictions severely limit the import/export of rapid prototyping machines, so this guide only covers systems available in the U.S.

3.1 Stereolithography

Patented in 1986, stereolithography started the rapid prototyping revolution. The technique builds three-dimensional models from liquid photosensitive polymers that solidify when exposed to ultraviolet light. As shown in the figure below, the model is built upon a platform situated just below the surface in a vat of liquid epoxy or acrylate resin. A low-power highly focused UV laser traces out the first layer, solidifying the model's cross section while leaving excess areas liquid.

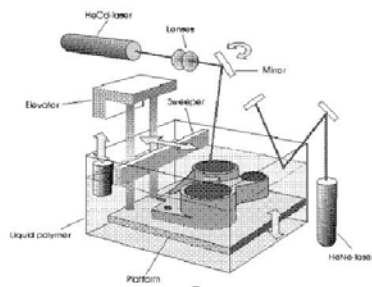


Figure 1: Schematic diagram of stereolithography.⁷

Next, an elevator incrementally lowers the platform into the liquid polymer. A sweeper re-coats the solidified layer with liquid, and the laser's second layer atop the first. This process is repeated until the prototype is complete. Afterwards, the solid part is removed from the vat and is of excess liquid. Supports are broken off and the model is then placed in an ultraviolet oven for complete curing.

Statische html-Datei: Lehrmaterialien

designs from properties such as stiffness, surface, impact behavior, weldability (as they are directly influenced by the chosen polymer to be formed), it has been of great interest to the firm industry to use a blend of linear and branched resins. The effect of varying the amount of linear propylene resin on the weldability and expandability is investigated. Since the expansion ratio is a sensitive function of temperature, the blends are processed at various temperatures using a thickening extrusion system. The cell density, expansion ratio, and cellular morphology of the extruded films with different contents of branched resin are measured and compared.

EXPERIMENTATION

Experimental Setup
Figure 1 shows a schematic of the tandem flow extrusion system. It consists of a 5 hp extruder driven with a speed control gearbox (Gardner, Day Center), a flat 10" extruder (Gardner, 55-25-500) with a mixing screw (Gardner, 55-25-500), a second 1 1/2" extruder (Gardner, 55-25-500) with a heater 15 hp variable speed drive motor with a 10:1 L/D ratio, a positive displacement pump for injecting the blowing agent in the polymer melt, a static mixer (Orange, TMS-0444-05) as a diffusion-enhancing device, a gear pump (Gardner, 55-25-500) which provides metering and initial cooling for the polymer melt. The gear pump controls the polymer melt flow rate, independent of temperature and pressure changes. The heat exchanger provides further cooling for the polymer melt to suppress cell coarsening. Shaping and forming are done in the filament die.

Experimental Materials
The extrudate used in this study were linear: stacked polypropylene and high melt strength (HMS) branched polypropylene materials supplied by Borealis GmbH. The MFR (300 1133, 230 °C/2.16 kg) of linear propylene material is 2.5 g/min. The MFR of branched propylene material is 2.5 g/min. The MFR of branched extrudate can be seen from Figure 2, both measured by using the so-called Elongation method with die L/D=10/2, 125 mm² down-draw and melt temperature of 200 °C, fed by Helela in extruder. In melt extrusion, extrudate is extruded through a capillary die and pulled down with increasing velocity (or constant acceleration) by using a pair of wheels, and the three is measured till rupture occurs. The

maximizes force is called melt strength, and the draw-down velocity at break is a measure of melt extensibility. Obviously, the pure linear PP (sample 1) has low level of melt strength and melt drawability. In contrast, the pure branched HMS propylene polymer (sample 2) shows a similar MFR a very high melt strength in combination with an almost doubled melt extensibility. The non-linear increase in force indicates strain hardening, which is well-known from long-chain branched materials, such as low-density polyethylene. When looking at the blends of pure linear and pure branched propylene polymers (samples 3, 4, 5) it can clearly be seen that melt strength, melt extensibility and strain hardening behavior increase with the amount of added branched HMS material.

The blowing additive used in this study was rice as the carbonizing agent with a fixed amount of 0.8 wt%. The blowing agent used in the experiments was nitrogen, C.P. (Matheson, 99.99%) with a fixed content of 10 wt%. The applied blowing rates of linear to branched components were 80/20, 50/50, and 20/80 wt%, respectively.

Experimental Procedure
The linear and branched polypropylene pellets, mixed with rice, were first dry-blended. The blend was fed into the barrel through the hopper and was completely melted by the screw rotation. Then, a certain amount of blowing agent was injected into the extrusion barrel by a positive displacement pump at a given percentage of weight and mixed with the polymer melt stream. When the gas was injected into the extrusion barrel, the extruder and the static mixer generated shear field that completely dissolved the gas in the polymer melt via convective diffusion [30]. The extrudate extrusion was then extruded through a capillary die.

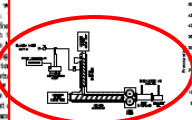


Figure 1: Experimental setup

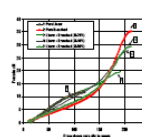


Figure 2: Melt strength and melt extensibility of polypropylene extrudate

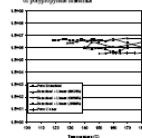


Figure 3: Effect of blowing on the cell density

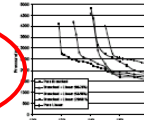


Figure 4: Effect of blowing on the die pressure

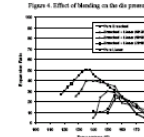


Figure 5: Effect of blowing on the volume expansion

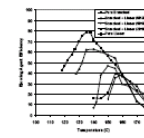


Figure 6: Effect of blowing on the blowing agent efficiency

The Power of Global

VL3200

Airflow
Operation
Turbine Stages
Collapse Stages

Technical Specification VL3200

Item	Value	Design RPM	Design RPM
Pin Tip Diameter (inches)	68.5	128	11,000
Length Stage to Stage	128	Exhaust Jet Velocity (ft/s)	1917
Takeoff thrust	20,000 - 31,500 lb	Turbine pressure ratio (PR)	1.9
Flat rated temperature	86°	Efficiency (%)	86.4
Bypass ratio	6.75 - 5.1	Overall pressure ratio	27 - 29.8
Flat rated temperature	89°	Leading Edge (ft/s)	1,240 - 1,07

Global Corp offers a full line of gas turbine engines for a variety of applications. Covering a range from 400 to 40,000 horsepower, our engines power both marine vehicles as well as aircraft. The VL3200 is the most recent commercial product to be developed at Global Corp. This new engine covers the 28,000 to 34,000 pound thrust class and has been designed specifically for 200-passenger aircraft. Its currently offered on the Airbus A321, part of the successful E200 aircraft family and will enter service in the spring of 2006.

The VL3200 builds on proven technology gleaned from other Global Corp. advanced engine programs for 200-passenger aircraft operations. Global Corp. has incorporated technological advances in the VL3200 that enable a

reduction in parts count. With fewer parts, the engine has a lower acquisition and reduced maintenance cost. The VL3200 meets all current and anticipated noise and emissions requirements to provide longevity and high residual value. With reduced noise levels it will provide better revenue benefits, since the VL3200 will enable flights into many airports that have curfew and noise quotas.

For airlines contemplating the future acquisition of new 200-passenger aircraft, the VL3200 meets the requirements for low cost and clean, quiet, reliable and durable power.

In the last two decades, air traffic volume has increased considerably, whereas the total quantity of fuel consumed has remained almost

unchanged. The VL3200 follows the trend towards increased fuel efficiency. This has been achieved by raising the operating temperatures as well as the use of efficient aerodynamic design and by the use of lightweight materials. In order to further increase the efficiency of the VL3200 the clearance distance between the blade tips and casing has also been reduced. This increase in efficiency can save airlines significant operating costs. The implementation of advanced coatings in the VL3200 increases the surge margin, thus increasing the stability and active safety of engine flow conditions.

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Interaktive pdf-Datei:
Modell einer Turbine

Statische pdf-Datei: Experten-Paper



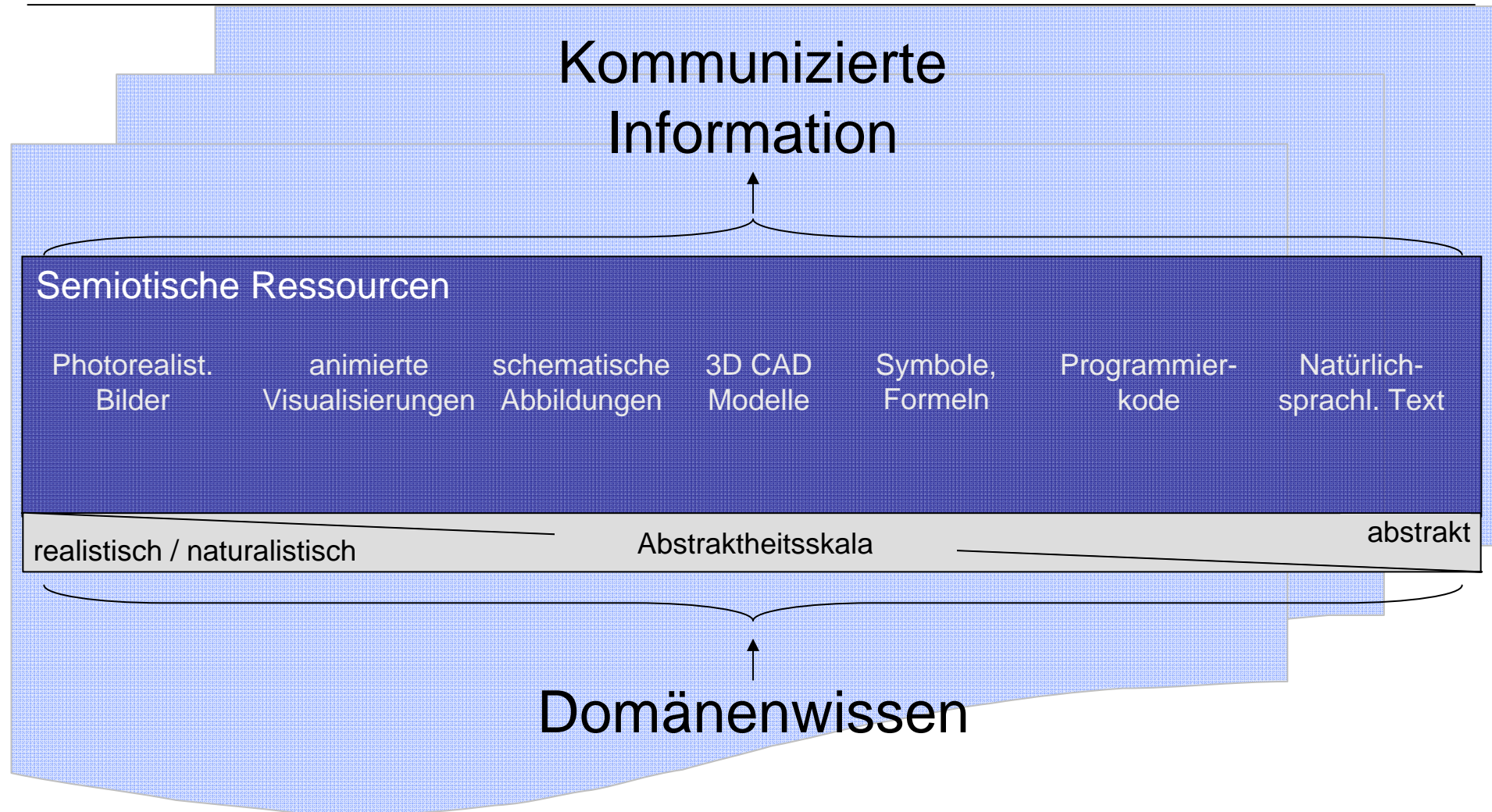
„Alle linguistischen Kommunikationshandlungen
umfassen mehrere Kommunikationskanäle. [...] Die für die Linguistik typische Fokussierung auf
monomodale Texte ist eine Abstraktion.“
(Bateman et al. 2002)

Forschungsgegenstand

Corpus multimodaler Dokumente



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- “A **multimodal text** is a text that uses several modes of communication (e.g., speech, writing, image) in an integrated way to convey a message or content.”
(Kress, van Leeuwen 2001)



- Analyse der einzelnen semiotischen Ressourcen
- Charakterisierung ihres individuellen und kombinierten Beitrags zur Bedeutungskonstitution des Gesamtdokuments
- Charakterisierung der Interaktion zwischen den verschiedenen semiotischen Ressourcen



- Corpus- und Computerlinguistik
- Multilayer XML-annotierte Corpora
- XLink / XPointer für intersemiotische Links
- XML-Standards bei Annotation und Query



- Corpus
 - Multimodale, wissenschaftliche Texte
 - Maschinenbau
 - Bauingenieurwesen
 - Informatik
 - Elektrotechnik
 - Biologie



- Zieldomäne: Datenverarbeitung in der Konstruktion, Subdisziplin des Maschinenbaus
- Semiotische Ressourcen:
 - Natürliche Sprache (~ 2 mio. tokens)
 - Visuelle Repräsentationen wie Photos, schematische Darstellungen, Skizzen etc. (~ 780)
 - Symbolische Repräsentationen: Formeln, Diagramme etc.
 - Mischformen: Tabellen, Repräsentationen von Datenstrukturen
 - Virtuelle Modelle, z.B. CAD (Computer Aided Design) Modelle
 - ...



- Diskurstenor: expert-to-expert, expert-to-learner, learner-to-teacher, expert-to-user
- Diskursmodus: written-to-be-read
- Texte:
 - Wissenschaftliche Artikel
 - Laborberichte
 - Buchkapitel
 - (instruktive) Webseiten
 - Technologiepräsentationen

Corpus

Überblick



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	expert-to-expert	expert-to-user	expert-to-learner	student-to-teacher
wissenschaftliche Artikel	X			
Laborberichte	X			X
Buchkapitel	X		X	
(instruktive) Webseiten	X	X	X	X
Technologie-präsentationen	X	X		

Corpus

Verteilung der Modalitäten



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	Text	Visuelle Repräsentation	Symbolische Repräsentation (Formeln etc.)	Mischtypen (Tabellen, Diagramme)	Virtuelle Modelle
wissenschaftliche Artikel	X	X	X	X	X
Laborberichte	X	X	X	X	X
Buchkapitel	X	X	X	X	
(instruktive) Webseiten	X	X	X		
Technologie- präsentationen	X	X		X	X

Forschungsfragen



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-
- Wie konstruiert eine Disziplin Bedeutung und Domänenwissen?
 - Wie geschieht dies mittels unterschiedlicher Modalitäten als semiotische Ressourcen?
 - Wie ist Multimodalität in Dokumenten einer bestimmten Zieldomäne instantiiert?
 - Welche Mechanismen sind verantwortlich für den gemeinsamen Beitrag unterschiedlicher semiotischer Ressourcen zur Bedeutung eines multimodalen Dokuments?

Ziele des Projekts



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-
- Untersuchung von größeren Mengen und diverseren Typen multisemiotischer Texte
 - Modellierung der internen Organisation einzelner semiotischer Ressourcen
 - Analyse des Beitrags unterschiedlicher Modalitäten zur Gesamtkonstitution eines Dokuments

Ziele des Projekts



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- Schaffung theoretischer und methodologischer Grundlagen für multisemiotische Registerstudien
- Überlegungen zu einem Modell multisemiotischer Texte
- Überlegungen zu einer Theorie multisemiotischer Register



- Ein reichhaltiges und systematisches Beschreibungsinventar – wie es für natürliche Sprache vorliegt – für die Beschreibung der anderen, nicht-sprachlichen Modalitäten
- Modelle für die Interaktion unterschiedlicher Modalitäten in multimodalen Dokumenten
- Ressourcen (Corpora, Tools) und Techniken für die computergestützte Analyse multimodaler Dokumente



- Intramodale Organisation
 - Organisation von Bedeutung innerhalb einer Modalität
 - ⇒ Intramodale Semiose
- Intermodale Organisation
 - Organisation unterschiedlicher Modalitäten innerhalb multimodaler Dokumente
 - ⇒ Intermodale Semiose



- Modalitätenspezifische Konstruktion und Organisation von Bedeutung
- Informationsspezifität einzelner Modalitäten
Wird die Wahl einer bestimmten Modalität durch die Art der zu vermittelnden Information determiniert?

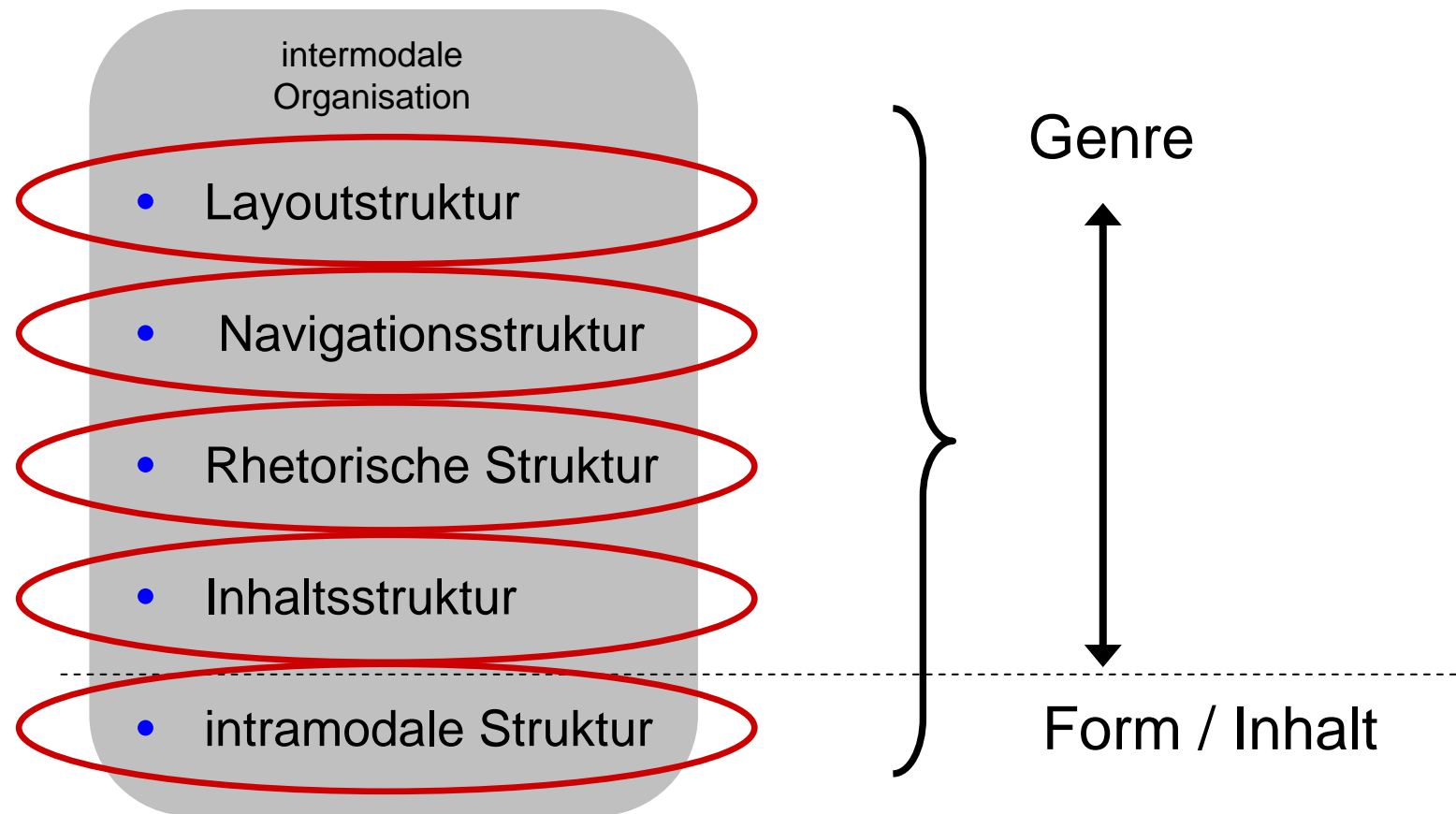


- Intermodale Beziehungen und Bezugnahmen
- Interaktion zwischen Modalitäten in der Semiose des Gesamtdokuments

Organisationsebenen multimodaler Dokumente



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adapted from the GeM model (Bateman et al. 2001)

Theorie

Theorie der Multisemiose auf Basis der SFG



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Metafunktionen	Modus	Beispiele (Sprache): (unterschiedliche Ranks)
ideational: experientiell	Konstruktion von Erfahrung als Bedeutung	Lexis (Wörter, Kollokationen), „Transitivity“ (Clause),
logisch		taxonomische Ketten (Lexis),
interpersonal	Ausübung sozialer Rollen und Beziehungen	Modus (Clause)
textuell	ideationale und interpersonale Bedeutung als „Informationsfluss“	Thema-Rhema (Clause), Kohärenz (Text)

Multisemiotische Textanalyse

Intrasemiotische Organisation



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Ideationelle Metafunktion	Natürliche Sprache	Tabellen	Programmier- -kode	Symbolismus: Symbole, Formeln	2D / 3D Modelle	Schemat. Abbildungen	Photorealist. Bilder
Experientielle Bedeutung	Lexikogrammat.: Vokabular, Terminologie	→	Schlüssel- wörter, Variablen etc.	Symbole, numerische Daten	Objekte, Benennungen, Prozessrepräsentationen		
	„Transitivity“: Prozesstypen, Partizipanten, Zirkumstantien		Prozesse, Kontroll- strukturen	Partizipanten und Operatoren	Prozesse, Partizipanten, Zirkumstantien , (Prädikat-Argumentstruktur)		
Logisch- semantische Relationen	Expansion, Projektion	Tabellen- typen (Kreuz- tabellen etc.)			Expansion, Projektion		

Multisemiotische Textanalyse

Intrasemiotische Organisation



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	Natürliche Sprache	Tabellen	Programmier-kode	Symbolismus: Symbole, Formeln	2D und 3D Modelle	Schemat. Abbildungen	Photorealist. Bilder
Interperson. Metafunktion	Modus, Modalität	Farbe, Schattierung, Rahmung, Highlighting	Processing instructions, Kommentare		Farbe, Schattierung, Rahmung, Highlighting		
Textuelle Metafunktion	lexikalische Kohäsion, grammatische Kohäsion, Konjunktions- beziehungen	Anordnung	Einrückung, Objekt- orientierung (Scoping)			Visuelle Kohäsion	

Intrasemiotische Organisation

Linguistische Textanalyse



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Situationelle Parameter	Feld, Diskurstenor, Diskursmodus		
Lexis	Terminologie Kollokationen		
Grammatik	Transitivität	Prozesstypen	material, relational, mental, existentiell, behavioral, verbal
		Partizipanten	Aktor, Ziel (Goal) etc.
		zirkumstantielle Elemente	temporale, kausale, ...
Textuelle Struktur	Kohäsion		kohäsive Ketten
	Thematische Struktur		Thema-Rhema
	Rhetorische Struktur		
	Generische Struktur		Prozesstyp-Distribution

Corpus Annotation

linguistische Annotation



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- Ideationale Features (natürliche Sprache)
 - PoS-tagging (Stanford NLP Tools)
 - Syntaktisches Parsing (Stanford NLP Tools)
 - Lexikalische Analysen (Kollokationen etc.)
 - Transitivität: Prozesstypen (UAM CorpusTools; O'Donnell 2007)
 - Textuelle Merkmale (Sprache)
 - Lexikalische Kohäsion
 - Thematische Struktur
 - Rhetorical structure (RSTTool; O'Donnell 2001)
- automatische
Annotation
- semi-
automatische
+ manuelle
Annotation

⇒ einige dieser Kategorien lassen sich auf andere semiotische Ressourcen übertragen, e.g. “Transitivity”, Kohäsion, Rhetorische Struktur



Patented in 1986, stereolithography started the rapid prototyping revolution. The technique **builds** three-dimensional models from liquid photosensitive polymers that **solidify** when exposed to ultraviolet light. As shown in the figure below, the model is built upon a platform situated just below the surface in a vat of liquid epoxy or acrylate resin.

A low-power highly focused UV laser **traces out** the first layer, **solidifying** the model's cross section while leaving excess areas liquid. Next, an elevator incrementally **lowers** the platform into the liquid polymer. A sweeper **re-coats** the solidified layer with liquid, and the laser **traces** the second layer atop the first.

This process is repeated until the prototype is complete. Afterwards, the solid part is removed from the vat and **rinsed** clean of excess liquid. Supports are broken off and the model is then placed in an ultraviolet oven for complete curing. [...]

→ Typen von Prozessen und deren natürlichsprachliche Realisierung



- Prozesse realisiert durch Verbalgruppen
- Partizipanten (Aktanten etc.) realisiert durch Nominalgruppen
- Zirkumstantien realisiert durch Adverbialgruppen und Präpositionalphrasen

Beispiel-Annotation



```
<s id="s5">
  <process type="relational possessive attributive">
    <participant type="carrier">
      <ne gId="nv30" id="ne25">
        <W Lpos="JJ">Such</W>
        <W Lpos="NNS">models</W>
      </ne>
    </participant>
    <ve gId="nv31" id="ve6">
      <lexvb lemma="have">
        <W Lpos="VBP">have</W>
      </lexvb>
    </ve>
    <participant type="attribute">
      <ne gId="nv32" id="ne26">
        <W Lpos="JJ">numerous</W>
        <W Lpos="NNS">uses</W>
      </ne>
    </participant>
    <W Lpos=".">.</W>
  </process>
</s>
```

„Such models have numerous uses.“



→ Generische Struktur

1 Overview of Rapid Prototyping

The term rapid prototyping (RP) **refers to** a class of technologies that can automatically construct physical models from Computer-Aided Design (CAD) data. These "three dimensional printers" **allow** designers to quickly create tangible prototypes of their designs, rather than just two-dimensional pictures. Such models **have** numerous uses. They **make** excellent visual aids for communicating ideas with co-workers or customers. In addition, prototypes can be **used** for design testing. For example, an aerospace engineer might **mount** a model airfoil in a wind tunnel to measure lift and drag forces. Designers have always **utilized** prototypes; RP allows them to be made faster and less expensively.

Einleitender
Paragraph:

**Relationale
Prozesse**

z.B. in
Definitionen
etc.

**Materiale
Prozesse**

z.B. in
Erklärungen
und
Beispielen



→ Konjunktions-Relationen in der generischen Textstruktur: Markierung räumlich-temporalen Relationen

[...] solid ground curing (SGC) is somewhat similar to stereolithography (SLA) in that both use ultraviolet light to selectively harden photosensitive polymers. Unlike SLA, SGC cures an entire layer at a time. Figure 5 depicts solid ground curing, which is also known as the solider process. **First**, photosensitive resin is sprayed on the build platform. **Next**, the machine develops a photomask (like a stencil) of the layer to be built. This photomask is printed on a glass plate above the build platform using an electrostatic process similar to that found in photocopiers. The mask is **then** exposed to UV light, which only passes through the transparent portions of the mask to selectively harden the shape of the current layer.

After the layer is cured, the machine vacuums up the excess liquid resin and sprays wax in its place to support the model during the build. The top surface is milled flat, and **then** the process repeats to build the next layer. **When** the part is complete, it must be de-waxed by immersing it in a solvent bath.

→ Kohärenz innerhalb des Dokuments

→ Organisation von Information

Intramodale Analyse

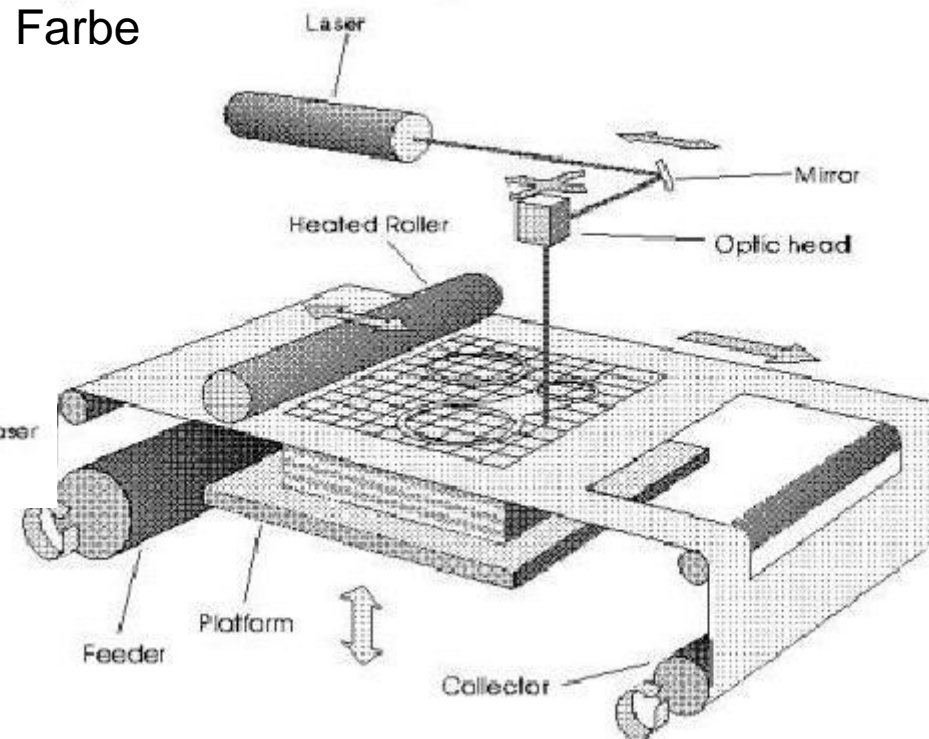
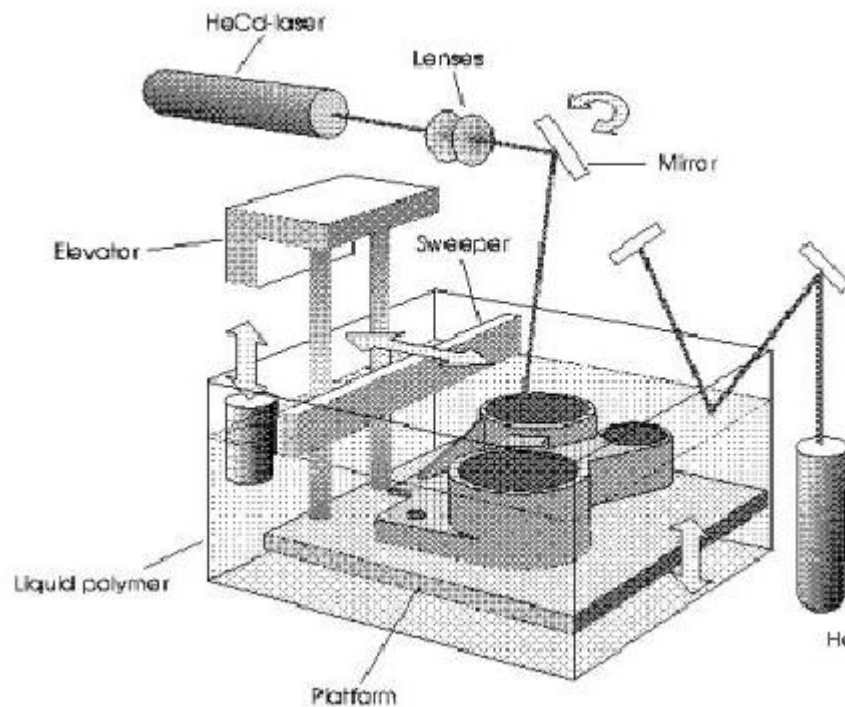
schematische Abbildungen



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Objekte & Parameter:

Formen
Linien
Textur
Farbe

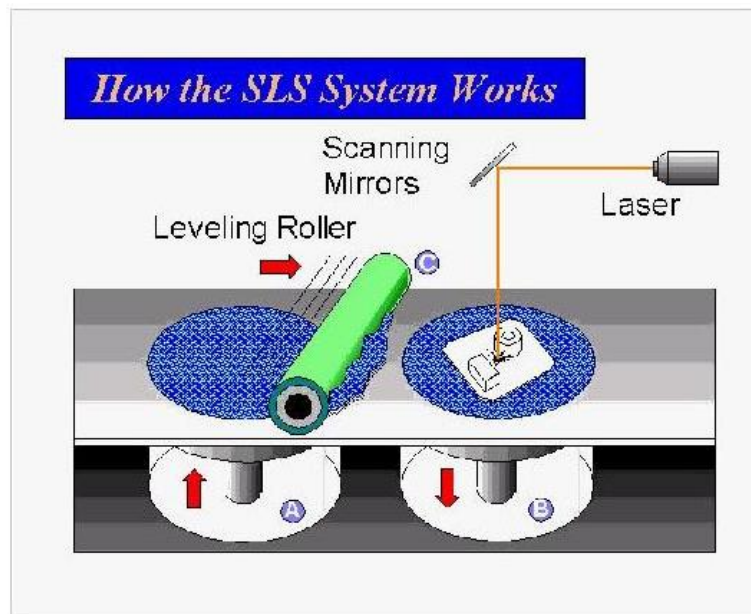


Intramodale Analyse

schematische Abbildungen



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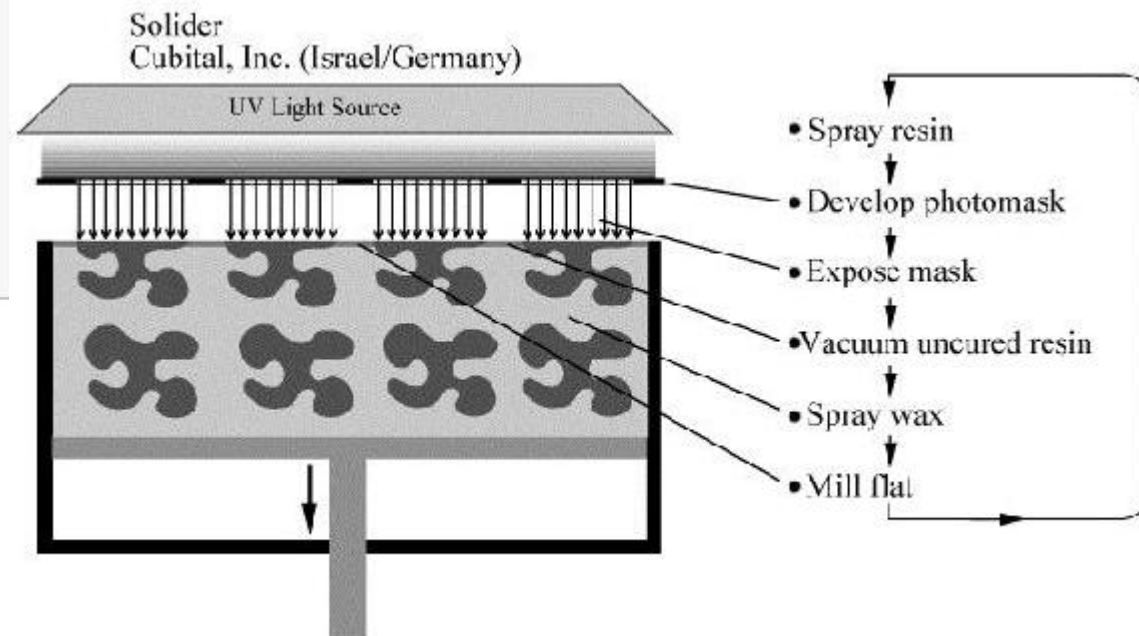
Semantische Einheiten:
Objekterkennung,
Prozesserkennung,
Themenerkennung
→ **Experientielle Bedeutung**

Strukturelemente:

Beschriftung,

Abfolgemarken (Pfeile,
Anordnung von Objekten etc.)

→ **'Textuelle' Organisation**



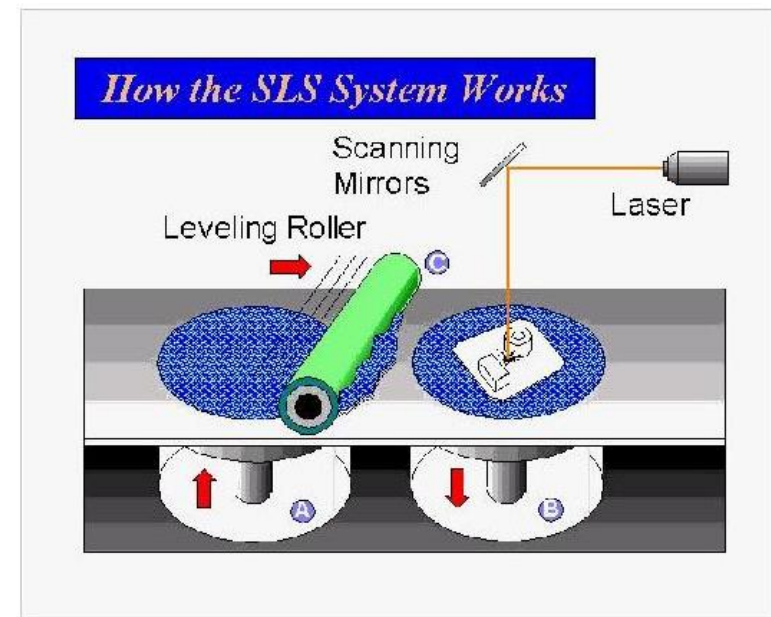
Intramodale Analyse

schematische Abbildungen



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- Objekte - Partizipanten:
laser, leveling roler, scanning mirrors
- Prozesse:
elevation (A), lowering (B), levelling (C)
- Zirkumstantien:
temporale und logische
Sequenzmarker, e.g.
[(A), (B), (C)], Pfeile →



Annotation

schematische Abbildungen



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Objects	PARTICIPANT: ACTOR PARTICIPANT: GOAL:	laser powdered materials into a solid object
Actions	CHANGE-STATE, ACTION MOVEMENT	fuse
Directionality	TRAJECTORY: vector, directionality	direction of object trajectory

```
<unit id="u-01.119">  
  <object function type="participant-actor">laser  
    </object>  
  <action function type="change-state">fuse  
    </action>  
  <trajectory type="uni-directional"></trajectory>  
</unit>
```


Intersemiose

in multimodalen Dokumenten



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	Natürliche Sprache	Intersemiose	Visuelle Modalitäten
ideational	Terminologie, Kollokationen; Prozesse, Partizipanten, Zirkumstantien	intersemiotische Links; intersemiotische Kohäsion; <i>transitions (macro- and microtransitions)</i>	Handlungen / Aktionen, Objekte logisch-semantische Relationen
interpersonal	logisch-semantische Relationen	logisch-semantische Relationen	
	Modus, Modalität	Rahmung, Hervorhebung z.B. aus didaktischen Gründen	Rahmung, Hervorhebung z.B. aus didaktischen Gründen
textuell	lexikalische Kohäsion, grammatische Kohäsion, Konjunktionsrelationen	intersemiotische Referenz, Rekurrenz, Repetition, Substitution, Ellipse, Rhetorische Struktur	visuelle Kohäsion, (explizite) Sequenzierung

Interaktive Merkmale: Hyperlinks, Menüs, Schaltflächen, Animationen



- intermodale phorische Links
as shown in, as exemplified in, ...

... as depicted in Figure x.x:

Single-Point Cutting-Tool Geometry. Figure 13.2.3 depicts the location of various angles of interest on a single-point cutting tool.

→ Unspezifische Verwendung,
kein guter Indikator für die Funktion einer visuellen
Modalität

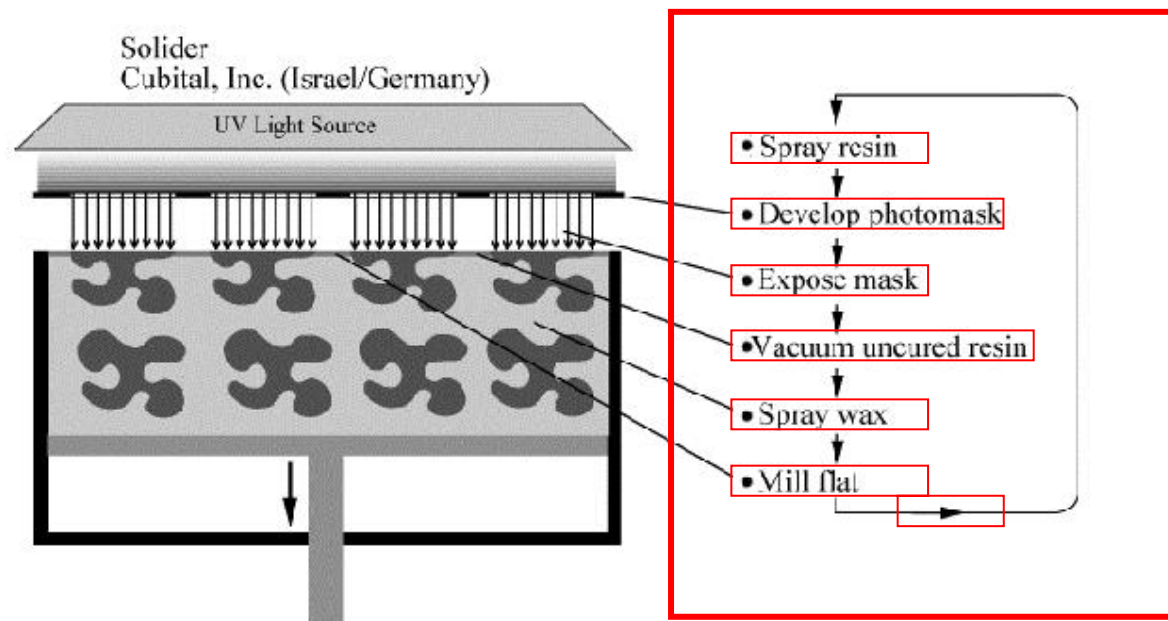


- Interaktionsstrukturen zwischen Modalitäten
 - Links zwischen Text und Bild
 - Multimodal referring expressions
Referenz auf Objekte durch mehr als eine Modalität
 - Crossmodal referring expressions
Referenz auf Dokumentteile (e.g. „Fig. 1“)
 - Anaphoric referring expressions
Referenz auf bereits eingeführte Objekte in verkürzter Form

cf. André, Rist 1994

3.4 Solid Ground Curing

Developed by Cubital, solid ground curing (SGC) is somewhat similar to stereolithography (SLA) in that both use ultraviolet light to selectively harden photosensitive polymers. Unlike SLA, SGC cures an entire layer at a time. Figure 5 depicts solid ground curing, which is also known as the solider process. First, photosensitive resin is sprayed on the build platform. Next, the machine develops a photomask (like a stencil) of the layer to be built. This photomask is printed on a glass plate above the build platform using an electrostatic process similar to that found in photocopiers. The mask is then exposed to UV light, which only passes through the transparent portions of the mask to selectively harden the shape of the current layer.



multimodal
referring
expressions

Figure 5: Schematic diagram of solid ground curing. 11

crossmodal referring expressions

After the layer is cured, the machine vacuums up the excess liquid resin and sprays wax in its place to support the model during the build. The top surface is milled flat, and then the process repeats to build the next layer. When the part is complete, it must be de-waxed by immersing it in a solvent bath. SGC machines are distributed in the U.S. by Cubital America Inc. of Troy, MI. The machines are quite big and can produce large models.

Intersemiotische Referenz

grammatische Metapher



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- verbale indikativische Phrasen im Text vs. imperative Phrasen in der Abbildung

“photosensitive resin is sprayed on the build platform”

VS.

“spray resin”



Anaphoric referring
expressions



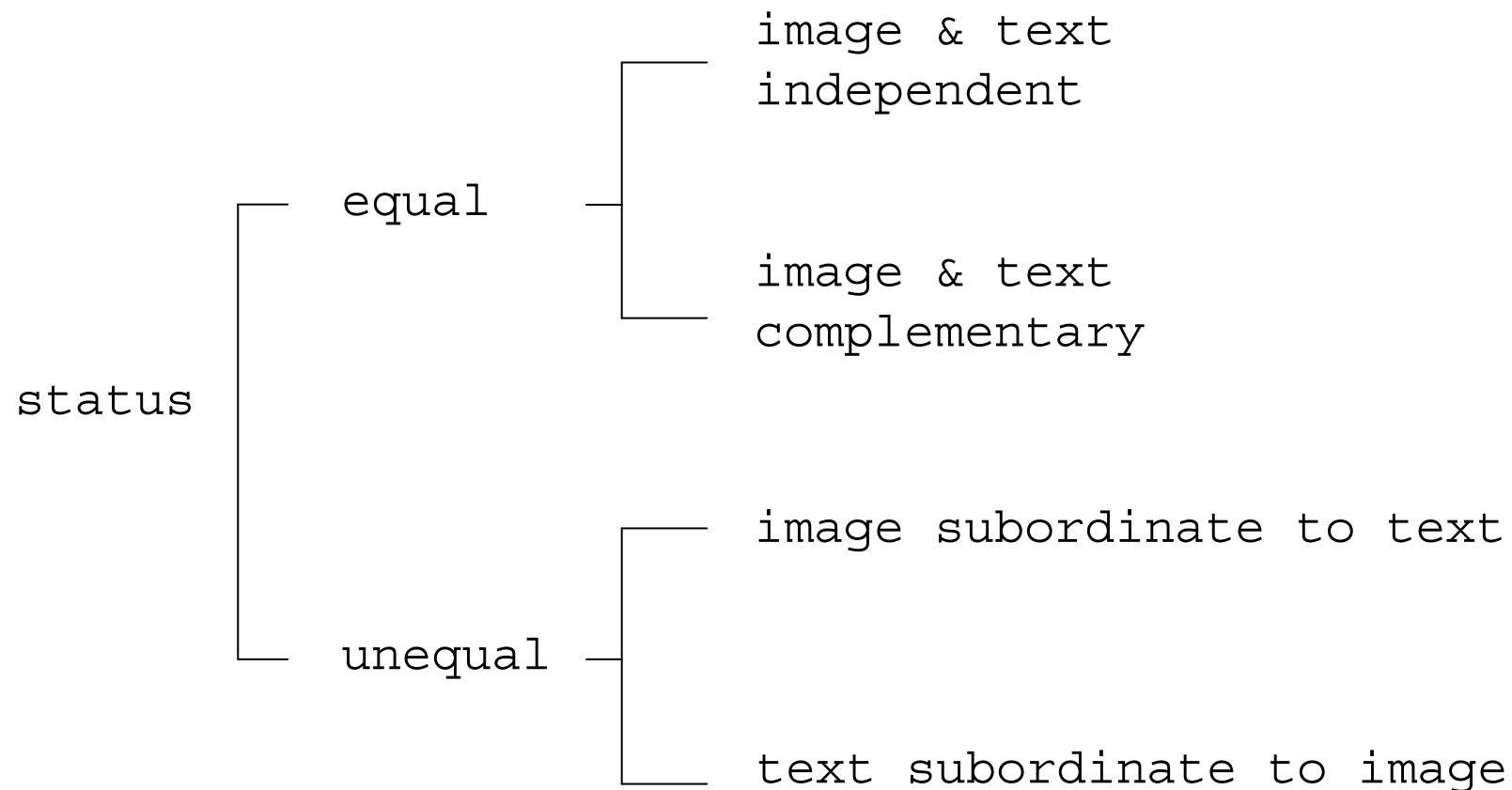
- Status der semiotischen Ressourcen:
equal | unequal
- Logisch-semantische Relationen
 - Expansion
 - Projektion

Intersemiotische Relationen

Status



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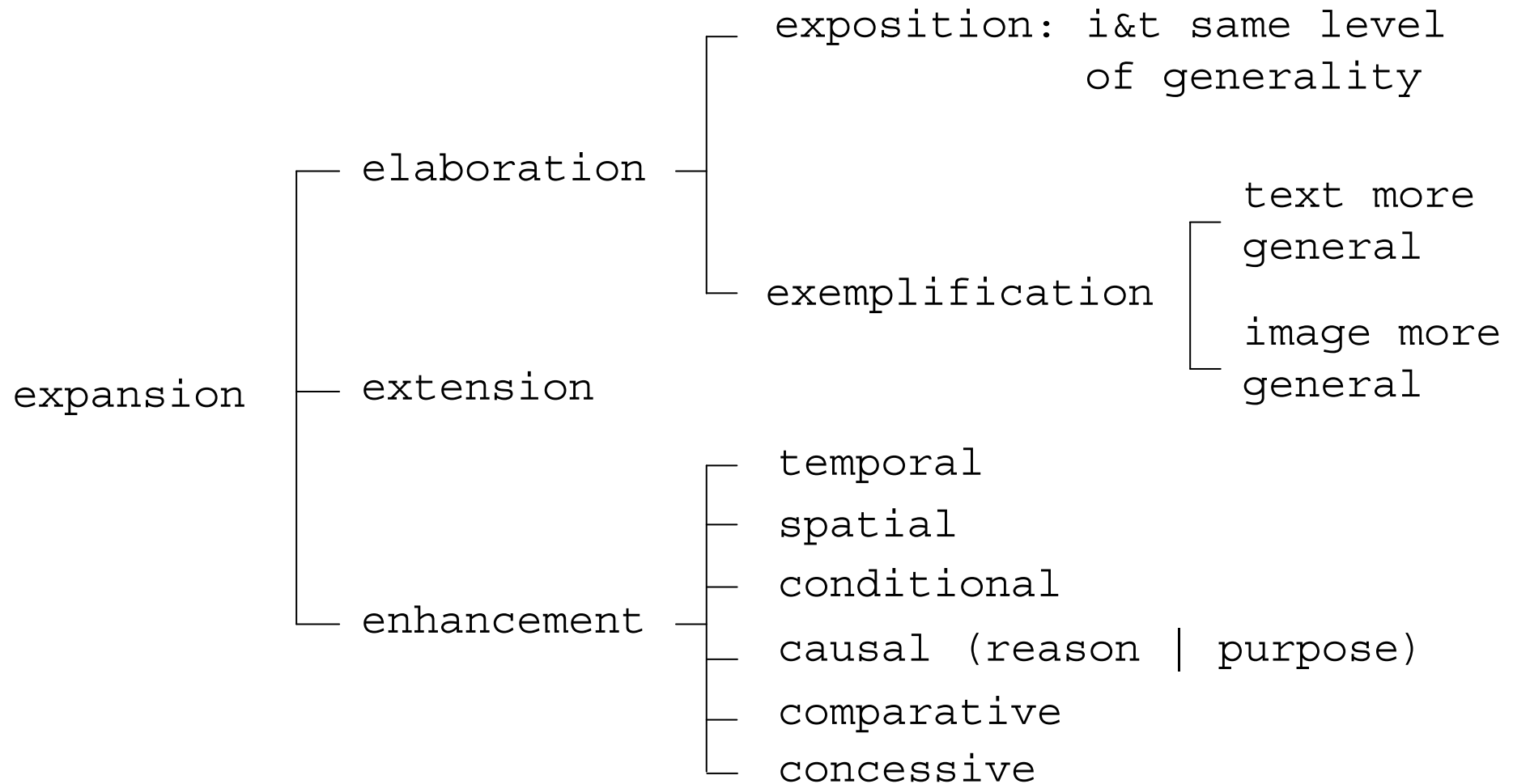
- Expansion:
 - *Elaboration* (... der Bedeutung einer Modalität mittels einer detaillierteren Beschreibung)
 - *Extension* (... der Bedeutung einer anderen Modalität durch Hinzufügung zusätzlicher, verwandter Information)
 - *Enhancement* (Erweiterung einer Modalität durch deren Qualifikation im Bezug auf Zeit, Ort, Cause und andere zirkumstantielle Elemente)
 - Projektion
 - Grammatische Metapher
- ⇒ Option der Erweiterung dieser Relationen durch weitere / zusätzliche Diskurselemente und andere Modalitäten wie zum Beispiel Bilder, Tabellen, Formeln, 3D Modelle etc.

Intersemiotische Relationen

logikosemantische Relationen



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Intersemiotische kohäsive Ketten

Objekte in unterschiedlichen Modalitäten

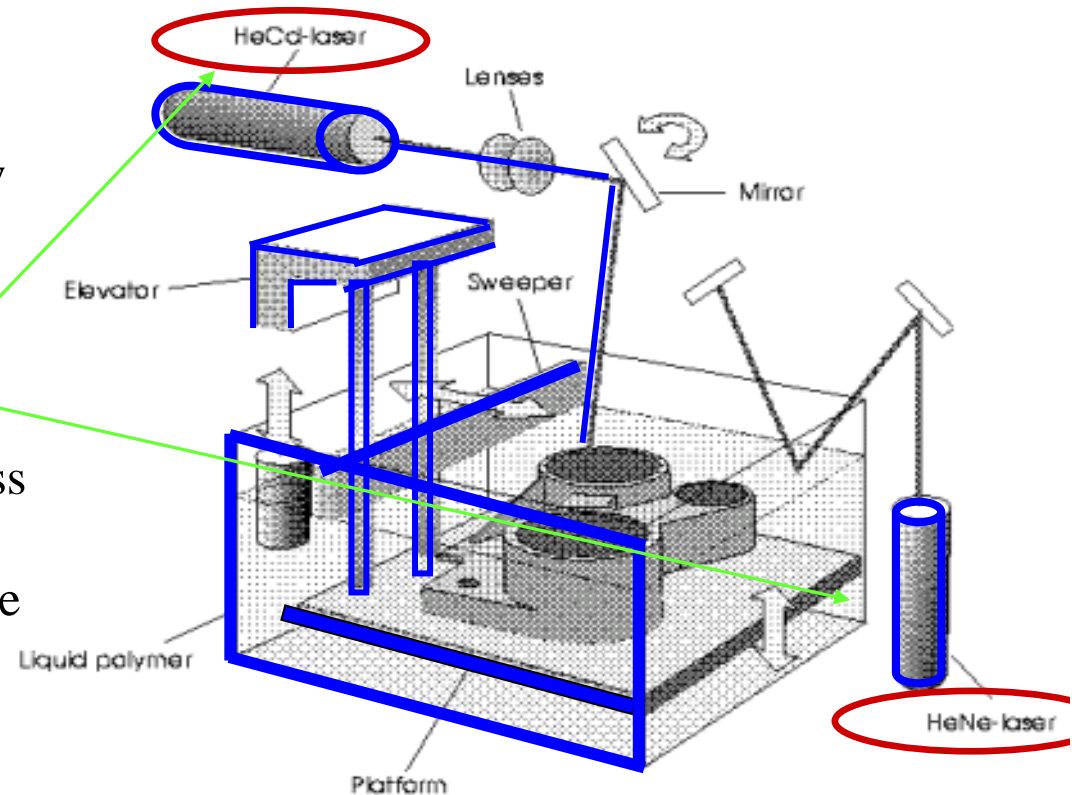


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The technique [**stereolithography**] builds three-dimensional models from liquid photosensitive polymers that solidify when exposed to ultraviolet light. As shown in the figure below, the model is built upon a **platform** situated just below the surface in a **vat** of liquid epoxy or acrylate resin.

A low-power highly focused UV **laser** traces out the first layer, solidifying the model's cross section while leaving excess areas liquid. Next, an **elevator** incrementally lowers the platform into the liquid polymer. A **sweeper** re-coats the solidified layer with liquid, and the **laser** traces the second layer atop the first.

Text allgemeiner als Bild



Intersemiotische kohäsive Ketten

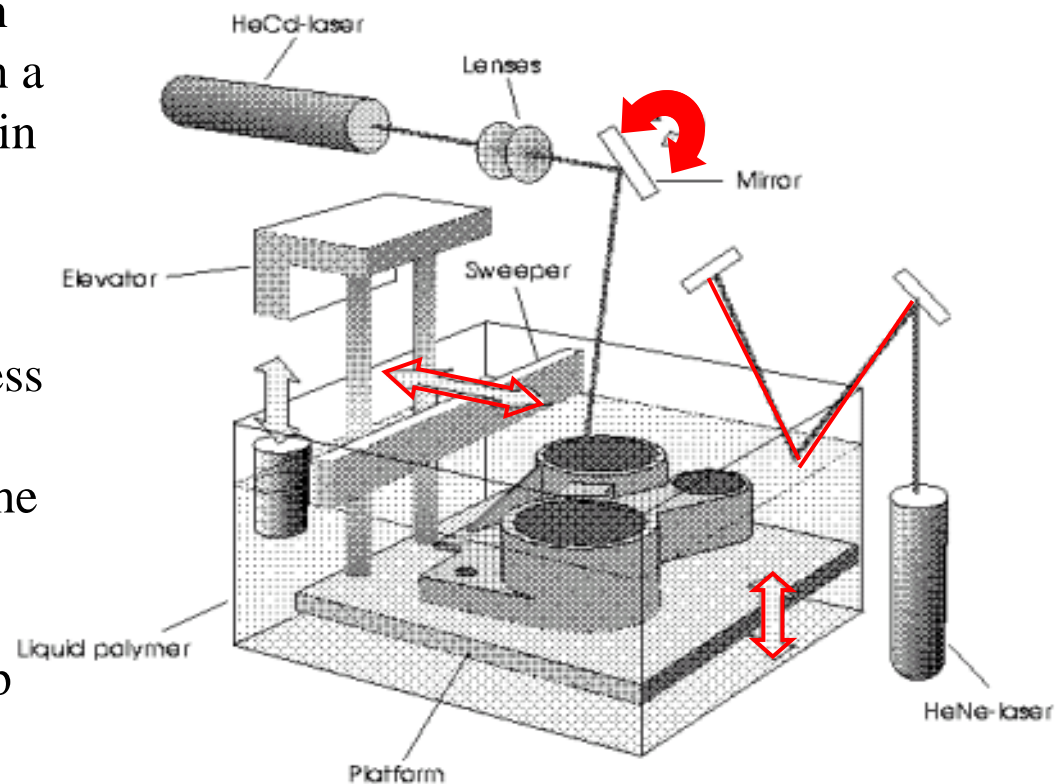
Prozesse in unterschiedlichen Modalitäten



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The technique [**stereolithography**] builds three-dimensional models from liquid photosensitive polymers that solidify when exposed to ultraviolet light. As shown in the figure below, the model is built upon a platform situated at the surface in a vat of liquid **complex lexical repetition** resin. A low-power highly focused UV laser traces out the first layer, solidifying the model's cross section while leaving excess areas liquid. Next, an elevator incrementally lowers the platform into the liquid polymer. A sweeper re-coats the solidified layer with liquid, and the laser traces the second layer atop the first.

Bild allgemeiner und unspezifischer als Text



Intersemiotische kohäsive Ketten

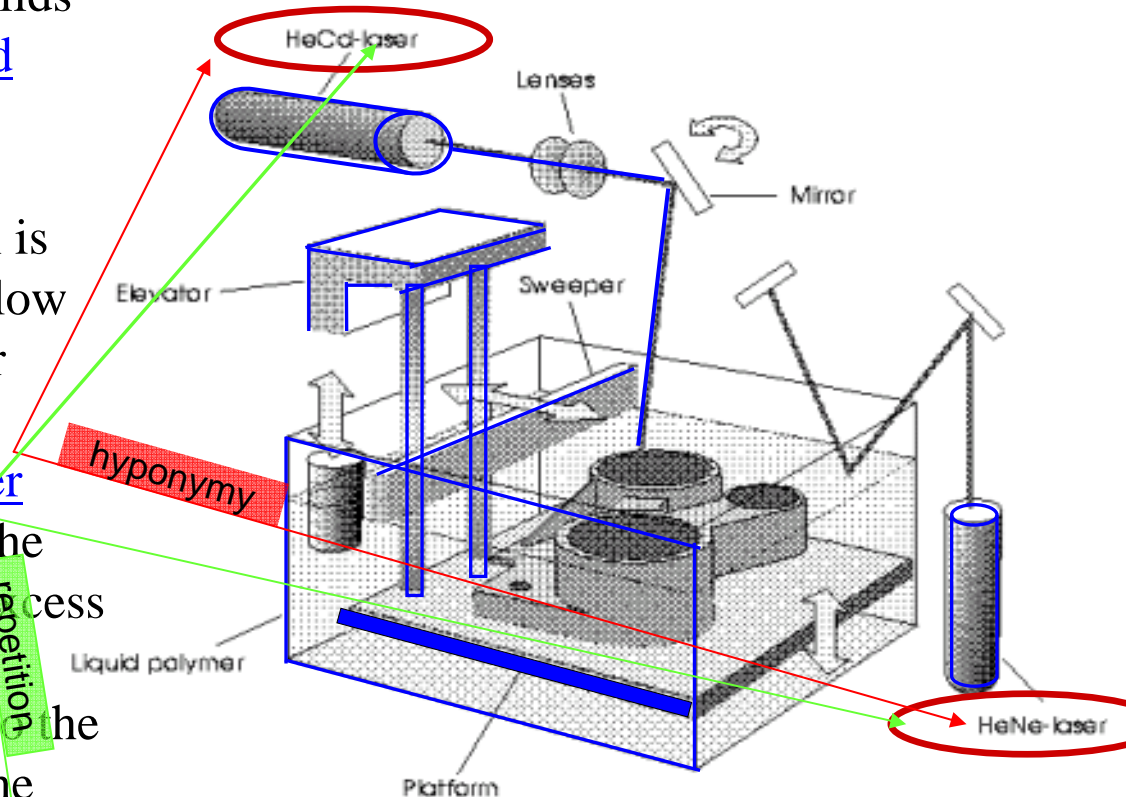
Objekte in unterschiedlichen Modalitäten



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The technique [stereolithography] builds three-dimensional models from [liquid photosensitive polymers](#) that solidify when exposed to ultraviolet light. As shown in the figure below, the model is built upon a [platform](#) situated just below the surface in a [vat](#) of liquid epoxy or acrylate resin.

A low-power highly focused UV [laser](#) traces out the first layer, solidifying the model's cross section while leaving excess areas liquid. Next, an [elevator](#) incrementally lowers the platform into the liquid polymer. A [sweeper](#) re-coats the solidified layer with liquid, and the [laser](#) traces the second layer atop the first.



Text allgemeiner als Bild

Prozesse der Intersemiose

Semiotic transition



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- *semiotic transition*
 - *micro-transition*
 - *macro-transition*

(cf. O'Halloran 2006)



- *semiotic transition*

- *micro-transition:*

Funktionale Elemente aus einer semiotischen Ressource
sind in einer anderen semiotischen Ressource enthalten

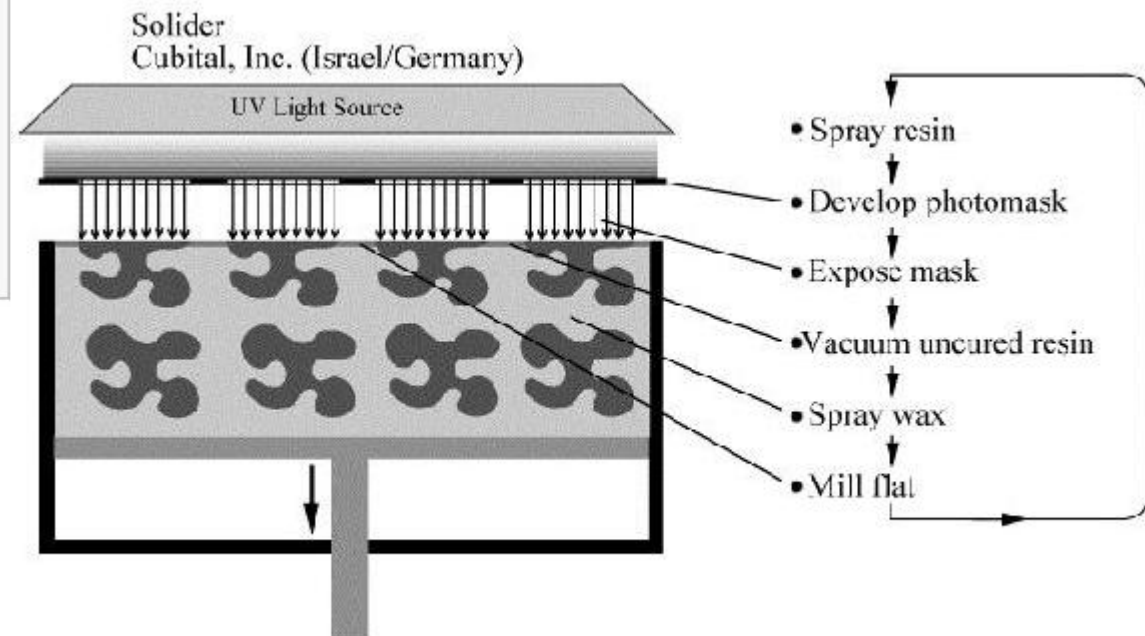
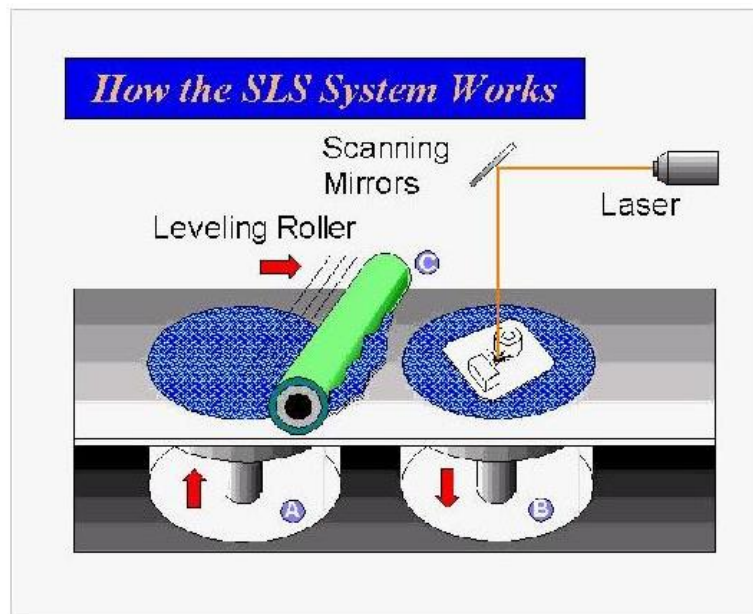
Beispiel: Symbole oder sprachliche Ausdrücke
in Diagrammen,
Sprachliche Ausdrücke in Formeln oder
schematischen Abbildungen

Intersemiose

semiotic transition



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- *semiotic transition*

- *macro-transition:*

Elemente aus einer semiotischen Resource werden durch Elemente aus einer anderen semiotischen Ressource ersetzt

Beispiel:

Sprache → Tabelle → visuelle Repräsentation als
Diagramm → Symbolismus (e.g. Formel)

O'Halloran (2004a)

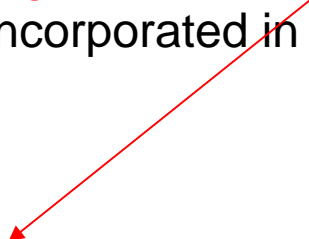


[...]

The interaction of software programs necessary for Curved LOM is **illustrated in Figure 2** (see [1] for an expanded description). The algorithms are incorporated in two separate packages.

[...]

REFERENCES

- 
1. Klosterman, D., R. Chartoff, N. Osborne, G. Graves, A. Lightman, G. Han, A. Bezeredi, S. Rodrigues, "Development of a Curved Layer LOM Process for Monolithic Ceramics and Ceramic Matrix Composites," *Rapid Prototyping Journal*, Vol. 5, Issue 2, 1999.
 2. Klosterman, D., R. Chartoff, N. Osborne, G. Graves, A. Lightman, G. Han, A. Bezeredi, S. Rodrigues, "Development of a Curved Layer Process for Fiber-Reinforced Composite Materials," *Eighth European Conference on Rapid Prototyping and Manufacturing*, Nottingham, UK, July, 1999.
 3. Klosterman, D., R. Chartoff, N. Osborne, G. Graves, A. Lightman, G. Han, A. Bezeredi, S. Rodrigues, "Curved Layer LOM of Ceramics and Composites," *Solid Freeform Fabrication Symposium Proceedings*, University of Texas at Austin, Austin, TX, August, 1998, pp. 671-680.

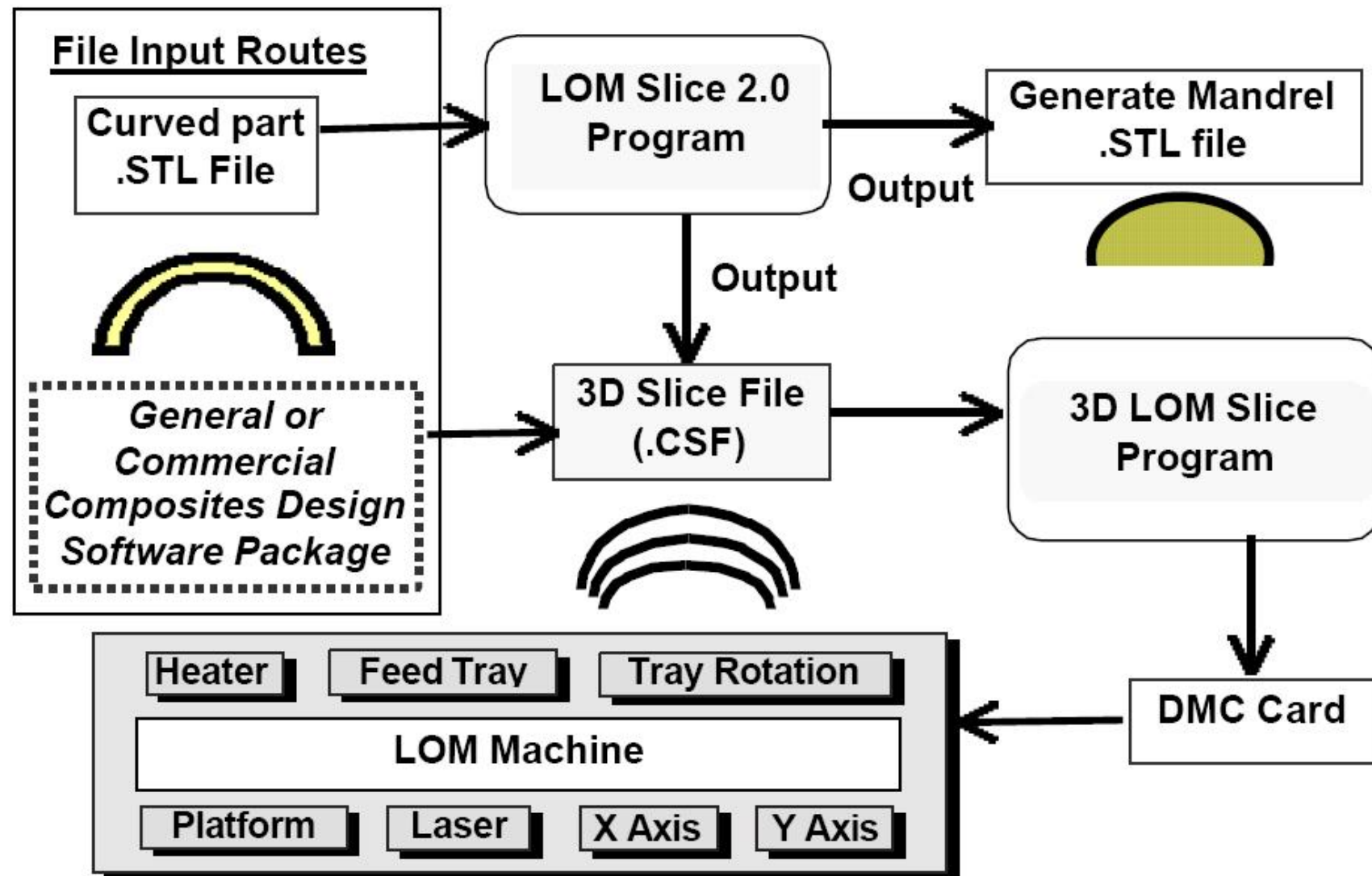


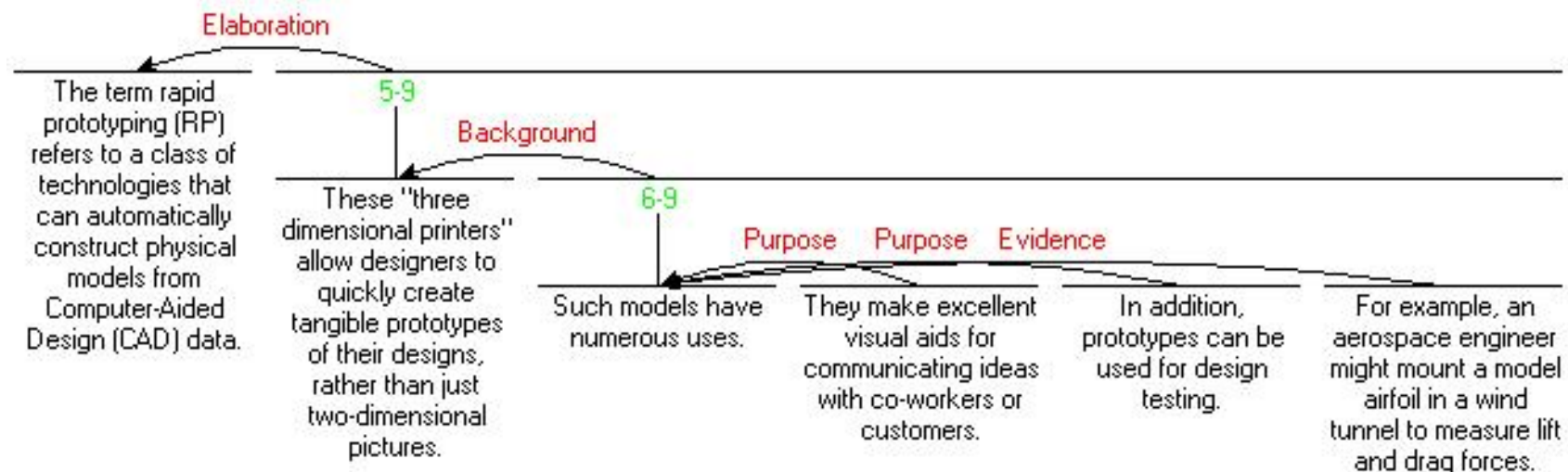
Figure 2: Interaction of software packages and file formats required for Curved LOM. The use of CSF files allows for direct use of general/commercial composite design software packages, by-passing the STL file.



- Intersemiotische Kohäsion
 - Aufgreifen des gleichen Konzepts in unterschiedlichen semiotischen Ressourcen
 - Substitution einer semiotischen Ressource durch eine andere, die das gleiche Konzept bezeichnet
 - Paraphrasierung eines Konzepts mittels einer anderen semiotischen Ressource
 - *Semiotic transition*
 - *micro-transition*
 - *macro-transition*



- Rhetorische Struktur



Rhetorical structure theory (Mann, Thompson 1987)

- Kohäsion innerhalb des Dokuments
- Organisation von Information

Was muss ein Modell multimodaler Register leisten?



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Modellierung ...

- der Binnensemantik unterschiedlicher Modalitäten
- der Interaktion zwischen Modalitäten (Links, Referenzen etc.)
- der Gesamtstruktur multimodaler Dokumente
- der Repräsentationsstruktur von Wissen in multimodalen Dokumenten

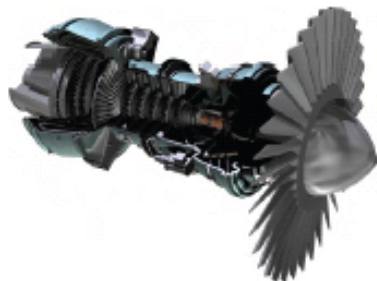
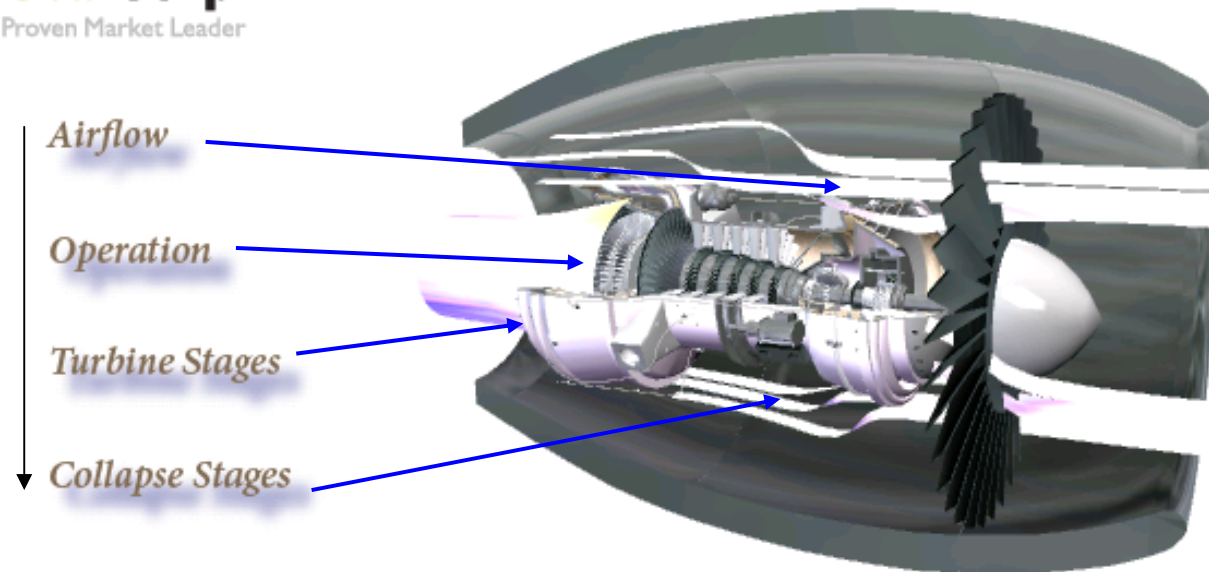
Beispiel Sonderfall 3d-pdf – Kohäsion und Interaktivität



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implizite
Sequenzierung



Technical Specification LV3200

Fan Tip Diameter (inches)	68.5	Design RPM	13,000
Length, flange to flange	128	Exhaust Jet Velocity (ft/s)	1917
Takeoff thrust	29,000 -31,500 lb	Turbine pressure ratio (t-t)	1.9
Flat rated temperature.	86°	Efficiency (t-t%)	86.4
Bypass ratio	4.75 - 5.1	Overall pressure ratio	27 -29.8
Flat rated temperature	89°	Loading (BTU/h/ft3/atm)	1.24E+07



- Multimodalität kennzeichnet eine große Zahl von Dokumenten besonders in den Natur- und Ingenieurwissenschaften
- Durch neue digitale Datenverarbeitungs- und Repräsentationstechniken werden sich die Möglichkeiten erweitern



- Multimodale Dokumente lassen sich anhand erweiterter Modelle der experientiellen, interpersonalen und textuellen Bedeutung sowie erweiterten Modellen der Kohäsion, Transition und Expansion modellieren
- Dies ermöglicht einen Beitrag zum besseren Verständnis multimodaler Dokumente mit dem Ziel der Verbesserung der Bildkompetenz



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