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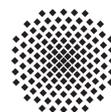Frank Leymann[1], and Lutz Ellrich[2]

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Abstract. A closer look behind the scenes of film making and media science reveals that the costumes used in film productions are products of a complex construction process. The costume designer has to put a lot of creative and investigative effort into the creation of costumes to provide the right clothes for a particular role, which means the costume reflects the place and time of play as well as it shows understanding of the characteristics of the role, actor and screenplay overall. Consequently, the creation of a costume is a difficult problem that is more or less occurring often, whereas the frequency of problem occurrence strongly depends on the genre and specifics of the film. For the genre of Western films, for example, the costume of a Wild West Sheriff is qualified for identification and description as a pattern because it appears frequently. In this paper, we propose a pattern language for composing costume patterns through a rich set of composition operators, more fine-grained costume patterns, and costume primitives. The pattern language aims at supporting media science, costume design, and costume management through providing a basis for the development of advanced information systems assisting the management of costumes considering their inherent structure and relations between their constituent parts. Our pattern approach is exemplified through deep-dive modeling of two costume patterns.

Keywords: Costume Language, Vestimentary Communication, Empirical Film Analysis, Pattern Language.

1 Introduction

Clothes are a visual communication medium that is used to transport particular information. Whereas the use of this so-called 'vestimentary communication' in the real world remains most of the time unconscious [8], the costumes in a film are carefully elaborated to give information about a certain role (e.g. a King), character (e.g. King Henry VIII), and associates stereotypes (e.g. charismatic like: rich person who cares little about the poor) as well as a particular place (e.g. England) and time (e.g. ~1530). The recipient of the information that is transported by the costume interprets associated messages trained through prior media socialization. In other words, when growing up surrounded by media such as books, films, television shows, and advertisements one knows that the role of a king typically wears a crown – without ever having seen a real king. Each costume is a solution to a design problem, which is defined through place and time of a film, the screenplay, a character, an actor it is tailored for, as well as expectations of the film director and intended film audience alike. As a consequence, the process of costume design requires significant effort in a creative, but also in an investigative manner.

Regarding the description of a costume solution and its elements there is however currently no widespread or standardized format or, speaking in terms of computer science, no formal model. Therefore, designed costumes are often described textually with additional sketches or photos. This circumstance makes the investigation for already existing costume solutions quite difficult as multiple different formats are used, each providing a different set of information artifacts and a different level of detail. Furthermore, good solutions, which have been created once, are hard to communicate due to the lack of a knowledge management methodology for this problem domain. Therefore, we propose a pattern language for costumes to (i) overcome the shortcomings in the current state of costume descriptions and (ii) enable advanced usage scenarios and applications through information system technologies.

The main target audience of this work is the group of costume designers in order to enable structured reuse of knowledge. Further, media scientists are targeted as they can increase the quality of research through a catalog of precise and formal costume descriptions. Also costume rentals and shops are a target audience, because a structured costume format would allow them to offer advanced accessibility to their offerings. This brings us to the last group – information system developers are also a target group because IT solutions like catalog systems, modeling tools, and digital marketplaces for structured data exchange are needed to support the approach from a technical perspective. In our case the audience of the approach is quite heterogeneous in its knowledge in the field of costume design, media science, and information technology. Therefore, we explain special terms from any of these fields when used, see also 'terminology tailored to the audience' by Harrison [3].

Our understanding of the terms around 'pattern' is explained in the following:

1. We understand a *pattern* as a good solution to a frequently occurring problem.

2. We understand a *costume primitive* as a simple piece of clothing, accessory, or costume-related props.

3. We understand a *costume pattern* as a good solution to a frequently occurring costume design problem. A costume pattern may be composed of costume primitives and other costume patterns. The composition description is the main solution aspect of a costume pattern.

4. We understand a *costume primitive format* as the formal model that each costume primitive conforms to.

5. We understand a *costume pattern format* as the formal model that each costume pattern conforms to. A costume primitive has only a subset of the attributes of a costume pattern. If required, a costume primitive can be converted to a costume pattern.

6. We understand *composition operators* as a grammar to compose costume primitives and costume patterns to more complex structures. Composition operators are crucial for the technical realization.

7. A *costume pattern language* is combining three sets: A set of costume primitives conforming to a particular costume primitive format, a set of costume patterns conforming to a particular costume pattern format, and a set composition operators.

Our understanding of a costume pattern is based on the needs of vestimentary communication. One could argue that costume patterns show some similarities with the term 'idiom' in the terminology of pattern languages of programs. However, costume patterns capture complex design problems and respective design solutions. Furthermore, applying and concretizing a costume pattern requires creative effort and expertise of a costume designer. Therefore, we argue that the term 'pattern' is more applicable.

Basically, costume patterns aim at providing a fast role understanding through efficient vestimentary communication building on established conventions of clothing in films, which are trained through media socialization. Whereas the costumes of the main cast need a high degree of individuality to be authentic, the stock characters have to be immediately understood when they appear. As we sketched in Figure 1, costume patterns focus on a high degree of stereotype in clothing while applying a low degree of individuality to ease perception of the vestimentary code. The more important a role in a film is, the more authenticity is required, which needs to be achieved through creative costume design. At the starting point of creative costume design there is always investigation needed on how other films have solved the design problem to dress a certain role. We argue that this investigation can be done a lot more efficient by applying and concretizing costume patterns. When working on the costumes for the stock characters efficiency is likely to increase even more. As highlighted in Figure 1 the pattern focus is located close to the stock characters, which are related to a high degree of stereotype clothing. Hardly any costume designer would dress a character without applying a few individual elements. Therefore the pattern focus does not cover an extreme degree of stereotype in clothing. The approach we present in this paper has many potential application areas, as we describe in more detail in Section 2. An application of the approach in the field of fashion suggests itself, but cannot be given at this point.
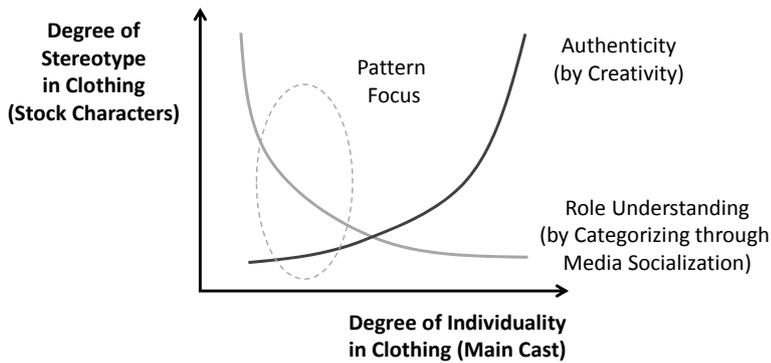
Figure 1: The costume pattern approach aims at fast role understanding through usage of established conventions of clothing in films.

Figure 2 depicts an overview of the interrelations between concrete costumes and costume patterns. The interrelations are originating from a set of concrete costumes which have been used in films which had significant impact on the establishment of clothing conventions for a particular genre. In other words, these are costumes which have been used for famous roles, like 'Sheriff John Chance' in the film 'Rio Bravo' (1959). In this paper we show how a set of concrete costumes can be abstracted into a costume pattern by identifying commonalities, similarities, and multiple occurrences of particular costume primitives. Through abstraction, the concrete costumes become 'known uses' of the costume pattern. Going one step further, the identified costume pattern can be applied as conceptual basis for the design of a new Sheriff costume. The creative aspect of applying a pattern is to create a costume design which reflects requirements derived from the characteristics of the role, actor, screenplay and desired authenticity. Many decisions need to be made when applying a costume pattern. Concretization refers to these decisions, which includes for example deciding on concrete fabrics of costume primitives.
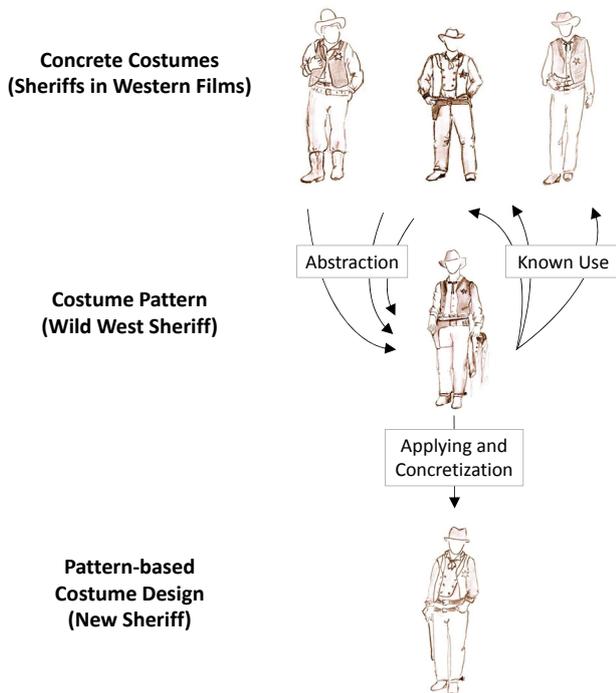

Figure 2: A costume pattern originates from abstraction of concrete costumes; vice versa, the concrete costumes become known uses of the costume pattern.

The paper's further structure is the following. In Section 2 we illustrate different scenarios which show the benefits of the approach in different application areas. In Section 3 we present the literature survey we conducted and the research design that we applied to design the overall costume pattern language. In Section 4 we discuss the format of costume primitives. Afterwards, in Section 5 we describe the costume pattern format that we use as formal model to describe costume patterns. Then, in Section 6 we elaborate on the composition operators we propose as grammar for describing the composition of complex costume

solutions out of costume primitives and more simple costume patterns. In Section 7, three costume primitives are presented. In Section 8 we perform the deep-dive modeling of one complex costume pattern in detail, the Wild West Sheriff. As a contrast we present another pattern in Section 9, the Wild West Outlaw. Differences and commonalities of patterns are discussed in Section 10. The paper concludes with a summary and outlook in Section 11.

2   Potential Application Areas

In this section we discuss different scenarios and list multiple stakeholders that benefit from the approach of capturing knowledge about complex costumes in a structured way. The major aim is to provide new insight into unrevealed secrets of vestimentary communication which can be utilized for practice of costume design. The vision we present is beyond of what is currently possible, as we describe in more detail in the literature survey in Section 3. The overall vision and the interrelation of scenarios are depicted in Figure 3.
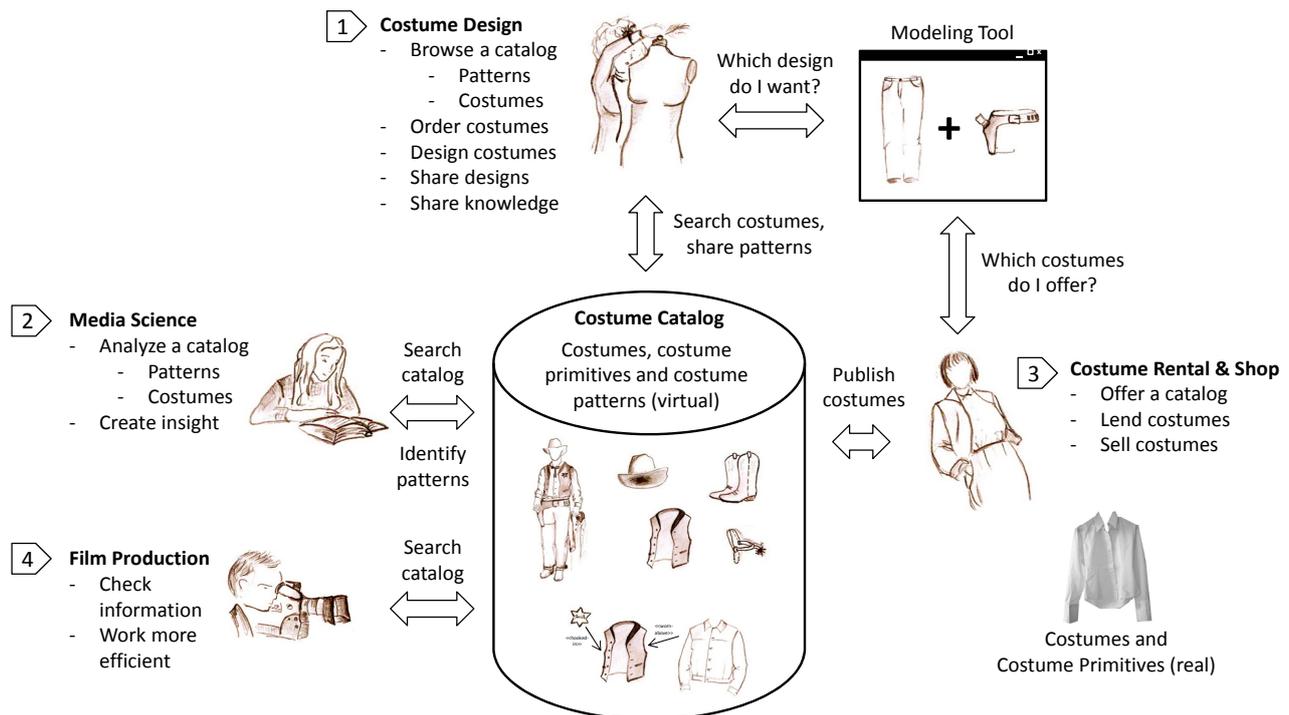

Figure 3: Different scenarios to illustrate the benefits of the approach, ranging from costume design (Scenario 1), media science (Scenario 2), costume rental and shop (Scenario 3), and film production (Scenario 4).

Scenario 1: Reusing and sharing knowledge of costume design

The costume designer is not only concerned with the design of costumes, but also with their organization. This means, when a costume design is ready, the pieces of clothing needed to realize the design have to be found on the market for being lent, bought, or otherwise they need to be tailored or manufactured on demand. The key question is how to make complex solutions to costume design problems reusable. The core solution aspect that a costume constitutes is how it is composed out of more simple parts and how they relate to each other. A modeling tool could be a useful support to describe such compositions in an easy-to-use and consistent manner. To make this knowledge easier accessible and more structured it needs to be refined with information beyond its structure, for example indicating the usage context and a description containing important keywords. The costume pattern language supports this scenario through an extensible format to capture that knowledge. Furthermore, distilling costume design knowledge into a pattern format allows easily sharing it with others, and also easily consuming costume design knowledge shared by others.

Scenario 2: Analysis of vestimentary communication in media science

It is hard to provide evidence for theories in media science related to costumes in films. For example, how could one *validate* the assumption that there are 'stereotyped costumes' that allow a particular audience to quickly understand the role of a supporting actor just by seeing him for a short time? With a structured format for costumes we would like to provide a new way for validating such assumptions. By focusing only on a particular film genre and time and through the use of abstraction we aim at identifying patterns of costumes and structurally describing them. For this, a costume pattern language is required, of which we present an initial sketch in this paper. However, this language is just the start for research in vestimentary communication that is based on information technology for the humanities. We envision a large catalog of costumes and costume patterns that can be analyzed by media scientists to create new knowledge and insight by applying techniques like data mining and statistical reporting, for example to analyze the frequency of a particular combination of pieces of clothing in a particular genre. A question that can possibly be answered through information technology is, for instance, how established conventions of clothing in films changed over time. The answer a system might provide would be rather structural and mathematical, which is a new way of media science research in this field.

Scenario 3: Costume rental and shop with advanced accessibility

From the perspective of a costume rental or costume shop the aim is to ease the access to the pool of available costumes and constituent elements in order to increase profit. Current state is to provide potential customers with the access to a database where descriptions of available costumes are virtually stored. Search functionality, e.g. based on keywords or text contained in the costume description, is state of the art in such systems. However, when modeling costumes on a level of detail that is more fine-granular than treating costumes as monolithic entities, such a system can provide much more functionality. For 'virtualizing' a real costume we propose modeling all of its constituent parts as 'costume primitives' and to link them to structured costume descriptions. Then a user of the database, e.g. a costume designer, could submit a search query formulated as complex costume. This query could be broken down into a set of pieces of clothing which are contained in the costume. The database can then create an according offer based on the parts available on stock. The benefits of such a system become even clearer when applying the dimensions of film productions. For instance, if Wild West clothing for thirty extras ('Statisten' in German) representing a gang of outlaws is needed, the required clothing could be expressed as a costume pattern used to query the database which then compiles thirty concrete costumes. This way, the costume pattern language would increase accessibility of costumes and clothing.

Scenario 4: Efficient work with costumes in a film production

The dressers in a film production are working for the wardrobe department. They are responsible for the availability of the right costumes at the right time and that the actors get dressed properly. They are also responsible for continuity regarding costumes, which basically means that, for example, from one shooting day to another a shirt should look exactly the same and should be worn the same way. For dressing an actor properly, the ordering of applying the different parts of the costume and how they are related to each other are relevant, representing an operational point of view. A well-defined format to describe a costume and additional information that instructs a dresser how to use it properly are therefore quite handy and make the work with costumes in a film production more efficient.

IT Perspective: Development of information systems for costume management

The information systems perspective is cross-cutting all four scenarios described before: a tool is needed for graphically modeling costumes and costume patterns, a catalog system is needed for storage, versioning, and search, and also analysis methods to operate on such a catalog are needed. Figure 4 depicts the information system development perspective which reveals different challenges that need to be addressed. Development starts with managing the requirements from the different stakeholders of such information system. These requirements describe the functions needed and the features desired to obtain a system that provides significant advances compared to the systems currently in use. The requirements of the stakeholders are also

represented in form of the costume pattern language. Having a clear view on these requirements the first step can be made, which is to formalize the costume pattern language to provide the basis for its support in a costume catalog and modeling tool.
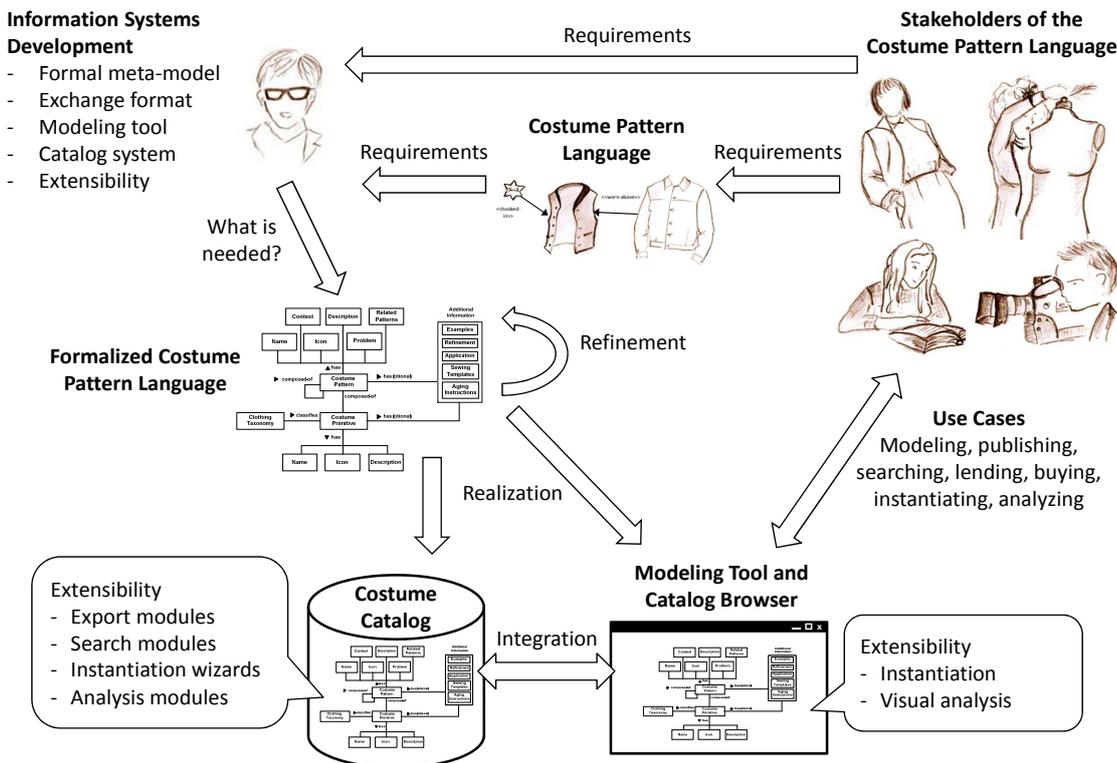

Figure 4: The IT Perspective, which considers information systems development, is cross-cutting the other scenarios.

Regarding the costume catalog, a data format for structured data exchange needs to be designed for building up a digital marketplace where costumes can be lent, bought, or manufactured on demand (catalog extensibility: export modules). A major challenge in the architecture and development of the costume catalog and modeling tool is to support creative work, which is very much ad-hoc and flexible, thus the requirements regarding functions tend to change over time. Different types of search are required to support the different stakeholders' needs, for instance a costume designer may specify a search query as a composition of costume primitives (catalog extensibility: search modules). There is also a need for different wizards that assist a user in instantiating a costume design, i.e. choosing real pieces of clothing (extensibility: instantiation wizards). Also different analysis modules are needed for specific types of film analysis. For example, the usage of particular data mining techniques like segmentation or profiling could be used to analyze the 'fingerprint' of a costume designer. A costume shop owner might be more interested in an analysis module that provides recommendations, which parts 'fit' to other pieces of clothing (catalog extensibility: analysis modules). Such information can also be used in web shops for clothes providing product recommendations for customers based on products in the shopping basket. Regarding the modeling tool, which may also provide catalog browsing functionality for a good user experience, there are similar requirements for extensibility. The instantiation of designs also needs to be supported in the modeling tool, demanding for integration of the modeling tool with the costume catalog. Furthermore, the results of the analysis modules operating on a catalog need to be made visible to the user, therefore extensions are required to support visual analysis.

3   Literature Survey and Research Design

Film making is a challenging domain in many different aspects. Many organizational units are involved in film making, forming highly complex business processes. Many different stakeholders are participating in the different phases of film making, which are namely development, pre-production, production, and post-production [27]. As described in [26], established organizational aspects of film making can be abstracted to patterns of roles and patterns of products, which these roles use and create. Such knowledge is very useful to get an overview of this very broad and complex problem domain. However, the different organizational units

and their business processes require more investigation. The focus in our work within the broad scope of film making and film analysis is set on the wardrobe department, which is responsible for the creation and management of costumes. Here, several problem domains exist: The domain of costume design and the research on vestimentary communication in media science that is associated with it, the domain of costume management for selling and lending costumes, the domain of tailoring costumes and pieces of clothing, and the domain of practical usage of costumes at a film set. Given these particular problem domains and narrowed scope, we conducted a literature survey to get a thorough understanding of current practice and science of costume design, available tool offerings, and related pattern approaches. The main results of this survey are described in the following. In order to increase transparency of our research and for traceability of the results we achieved, we subsequently describe our research design.

3.1 Literature Survey

Regarding the domain of costume design and related research, the main problem is to design a costume that reflects the place and time of play as well as it has to show understanding of the characteristics of the role, actor and screenplay overall. Complex aspects of vestimentary communication need to be considered. For example, physical requirements imposed on the costume like protection from high or low temperature need to be arranged with social expectations of the film audience and stereotypes trained through media socialization. Although costumes are a very important aspect in a film and although fashion and clothing have been more intensively discussed since the 1980s [2] [8] [18], the discussion of costumes in media science is still limited. Research was made in the course of the Mise-en-scène analysis [19], focusing on the communicative aspect [20], investigating the sign character of a costume [8], and discussing the relation between costumes and femaleness [21]. The term of a 'costume language' is used in many of these works, however metaphorically. Without neglecting the communicative aspect of clothing, the current state in research is that a common costume language is hard to develop due to the complex relationships of cultural, social, and situational aspects [8] [22] [23]. Barthes [2] developed an inventory system to describe the most significant aspects of clothes and to decompose them into their constituent parts. Burger [8] made this system accessible to film costumes. Though, to the best of our knowledge, there is still no formal approach in terms of a well-defined syntax and semantics to make costumes ready for processing in information systems.

The lack of an established format is also reflected in the next domain, costume management. Current tools are providing support for documentation, administration and inventory for costumes as a monolithic entity. Although the pieces of clothing a costume is composed of are known, this level of detail is not yet reached in practice. Prominent examples for such tools are go_disco [15] and Pro Fundus [16]. In current practice, either the format that a tool is using is applied or an individually defined format is used. Due to the lack of an established format, there is no integrated electronic marketplace where structured costumes can be ordered for buying or lending.

Regarding the domain of tailoring, the main problems are how to cut particular fabrics and how to sew them to obtain a piece of clothing. In fact, this domain makes use of so-called 'sewing patterns'. The approach of sewing patterns evolved in the second half of the 19th century giving also non-industrials the opportunity to represent and reuse a good composition of pieces of fabrics which can be sewed up to a piece of fashionable clothing [11]. Basically, sewing patterns are cutting and sewing templates which describe the shapes of the different elements of a piece of clothing [12]. Nowadays, sewing patterns still play an important role in the domain of tailoring, both in industrial practice and in the daily business of tailors working in film productions and theatres. There is a number of sewing pattern catalogs available, for example the Burda catalog [13], the Vogue patterns [14], or the COPA archive [17]. Recently, simulation systems have emerged in which sewing patterns can be tested virtually. For example, in [25] sewing patterns can be placed around a three-dimensional body. An integrated simulation system then computes the result of the sewing process to provide a so-called 'virtual try-on' to increase the efficiency of the design process. In the following, we refer to sewing patterns as sewing templates to make the discrimination towards costume patterns more clear. These templates can be seen as additional information as guidance for a tailor.

Regarding the domain of practically working with costumes on a film set, the problems are rather operational. For example, a problem is how to dress a particular actor with a given costume. For many costumes the operational knowledge is already available from daily life. For instance, the order of applying a shirt, trousers, socks, and shoes to an actor is quite clear. However, what about the order of dressing a complex uniform costume? For example, the uniform of a 'Stormtrooper' costume from the movie series

'Star Wars' consists of 25 parts which are either black or white [24]. To name another example, dressing a carnival costume can also be quite challenging if the ideal order of applying the parts is not known.

In conclusion, the main findings of the literature survey are:

- Currently, there is no established format and no formal language for complex costume descriptions.

- Costumes are usually described rather informally.

- Due to the lack of formal approaches there is also a lack of empirical research on the conventions of vestimentary communication.

- Tools supporting the administration and management of costumes typically treat costumes as monolithic entities.

- A pattern approach has, to the best of our knowledge, not yet been proposed to describe complex costumes to account for reusable solutions to costume design problems and knowledge capturing.

Given these findings, the major aim of the project has been set on designing and building an information system that is based on a pattern language for costumes to support the different stakeholders of the problem domain with an efficient and advanced solution to analyze, design, and manage costumes. To account for the different problem domains that benefit from the approach, the pattern language makes relations to available knowledge, for example the relation to sewing templates serves the tailoring domain.

3.2 Research Design

In order to establish a common vocabulary for information system developers, media scientists, and costume designers, we modeled and described the problem domain in terms of processes, documents structures, and roles involved in costume management in film making. The results of these efforts have been compiled to an article [4]. This article contains a refinement of what 'management of costumes' and patterns respectively comprises, namely costume modeling using a graphical editor, costume archival using a versioning system, costume queries (for search in a catalog, lending, and manufacturing), as well as managing costumes at a film set. However, an answer on how to design a pattern language in order to be used with that system was not provided. We created a preliminary pattern format, based on the attributes of prominent pattern formats. The resulting paper [1] illustrated the pattern approach, though, the pattern format and sample pattern was simply sketched.

We used this format as a starting point for usage, revision, and improvement. The attributes of the original format as well as the new or revised aspects are described in Section 5. Based on further literature study on costumes, fashion, and clothing, an initial set of costume primitives has then been identified, described in Section 4. These pieces of clothing provide the basic constructs for costume patterns. The set of costume primitives we discuss in Section 4 and Section 7 is far from being complete, as the field of clothing, fashion, and costumes in particular, is incredibly large. The costume primitives are described in a simple format to reduce the effort of applying the approach in practice and to support a quick start. This approach has also proven successful to reduce the complexity in the field of patterns of software architecture, as described by Zdun and Avgeriou [9].

To exemplify our approach, we then conducted a film study with a small set of selected films (called film corpus) to obtain two complex costume patterns that are specified in all details including the required operators to describe their composition from costume primitives and more simple patterns. The concrete composition operators used in these complex patterns have been abstracted to a composition grammar. To the ease of understanding, we designed a graphical notation to describe compositions. The resulting complex costume patterns are described in Section 8 (Wild West Sheriff) and Section 9 (Wild West Outlaw).

In the following, we describe the procedure we performed to identify the patterns step-by-step, see also Figure 5 for an overview of the procedure.

Figure 5: Step-by-step identification of costume patterns.

1. **Genre selection:** We decided for the genre of 'Classical American Western' as it (i) has a very limited, almost constant inventory of roles, e.g. a Sheriff, Cowboy, Outlaw, Indian, Saloon Lady, Bartender, or Piano Player occur frequently. Further, (ii) as it is the basis for multiple sub-genres like Italo Western or Space Western, it manifests the stereotypes and their costume conventions people obtain through media socialization. Also, (iii) the roles, especially the Sheriff, change their costumes seldomly, which increases the importance of related costumes for the vestimentary communication. Next to the 'Classical American Western' there are a lot of other genres, which would be appropriate for costume pattern identification. For example the Mafia-Genre or the High-School-Comedies are also defined by a collection of frequently occurring stereotypes. However, the definition and scope of genres is rather heterogeneous and there are some genres which are quite broad and versatile like the Thriller-Genre or the Science-Fiction-Genre. Further investigation is required to evaluate if the costume pattern approach works within such genres.

2. **Film corpus selection:** This step is quite important for the outcome of the pattern identification as it provides the basis of material that is abstracted into one or more patterns. We selected films, which are either highly ranked in critics or frequently discussed, ranging from early evolvement of the genre (Stagecoach) up to late films (Ride The High Country). The final film corpus is as follows:

   1. 1939 Stagecoach (German: Ringo)
   2. 1946 My Darling Clementine (German: Faustrecht der Prärie)
   3. 1952 High Noon (German: 12 Uhr Mittags)
   4. 1956 The Searchers (German: Der schwarze Falke)
   5. 1958 The Big Country (German: Weites Land)
   6. 1959 Warlock (German: Der Mann mit den goldenen Colts)
   7. 1959 Rio Bravo (German: Rio Bravo)
   8. 1960 The Magnificent Seven (German: Die glorreichen Sieben)
   9. 1962 Ride The High Country (German: Sacramento)

3. **Character selection:** The films of the selected corpus were analyzed and screenshots of the characters associated with the role 'Sheriff' and the role 'Outlaw' have been identified. In most of the films, the Sheriff and the antagonist 'Outlaw' were very important for the film, thus they are also very important from a costume design perspective. In six out of the nine films 13 different Sheriff characters and 22 different Outlaw characters were contained, varying in age, attitude, behavior, and authority (Sheriff, Deputy Sheriff, Marshal // Head of the Outlaws, Accomplice).

Stagecoach:	Marshal Curly Wilcox // Luke Plummer, Ike Plummer, Hank Plummer
My Darling Clementine:	Marshal Wyatt Earp, Luke the old Marshal // Old Man Clanton, Billy Clanton, three other Clanton brothers
High Noon:	Sheriff Will Kane, Deputy Harvey Pell // Frank Miller, Ben Miller, two of Frank Miller's accomplices
The Searchers:	–
The Big Country:	–
Warlock:	Deputy Roy Thomson, Deputy Johnny Gannon, Sheriff Eduard Calhoun // Abe McQuown, Curley Burne, Billy
Rio Bravo:	Sheriff John Chance, Deputy Stumpy, Deputy Dude, Deputy Colorado // Nathan Burdette, Joe Burdette
The Magnificent Seven:	–
Ride The High Country:	Ex-Marshal Steve Judd // Billy Hammond, Henry Hammond, three other Hammond brothers

4. **Costume description:** The costumes of the selected characters have then been described in detail from the perspective of the actor (regarding left and right), including the clothing elements of the costume (e.g. trousers) and the respective clothing specifics (e.g. material: jeans, color: blue stone-washed, form: five-pocket, aging: old and worn for several days). Modeling clothing elements contributed to the set of costume primitives.

5. **Composition description:** For the described costumes the operators have been identified that need to be available to specify a costume structure as a composition of costume primitives and, if applicable, of other costume patterns. This step contributed a basic vocabulary for the composition of costume primitives and more simple costume patterns.

6. **Abstraction to costume pattern:** In order to obtain the costume pattern, similarities and multiple occurrences of particular aspects have been identified. The 'Sheriff's Star' has been revealed as the most significant property in order to recognize a role functionally as a Sheriff which qualified it to be described as a costume pattern with a rich amount of attributes that characterize its aspects. For the 'Wild West', clothing like a hat, vest, or holster define place and time in a vestimentary manner. Thus, for the 'Wild West Sheriff' pattern both components are required, the Sheriff's Star pattern and the Wild West clothing.

4 Costume Primitive Format

In this section and the following section (Costume Pattern Format) we describe the results of our requirements analysis, mainly conducted from the IT perspective. For formalizing costumes and their abstraction to costume patterns we distinguish between costume primitives and costume patterns. Costume primitives are simple clothing elements which constitute the basics of our pattern language, whereas costume patterns include advanced concepts like composition graph and dressing sequences. These concepts are of vital importance for the costume patterns, but they can also be applied for different approaches which are not concerned with patterns, e.g. for modeling a particular outfit.

In the semiotic approach to clothing (semiotic means study of signs) we found an initial approximation on structuring and formalizing scientific findings, which we could build on to obtain a 'starter kit' of costume primitives. When we refer to costume primitives in the following, we do not break them down to the level of granularity as made by Barthes [2]. For example, we see a shirt as a costume primitive, although it is made up of buttons, a collar etc. Furthermore, we see a pair of boots as costume primitive, although it consists of a left boot and a right boot, which are possibly not even symmetric. However, as these boots are typically applied together and they are strongly related to each other, they are considered as one primitive.

A set of costume primitives can be derived following Barthes [2] description of meaningful elements of clothing, which have significant impact on the vestimentary communication: Accessory, Apron, Bag, Blouse, Bracelet, Cape, Clip, Coat, Dress, Glove, Handbag, Headdress, Jacket, Necklace, Shawl, Shirt, Shoe, Sweatshirt, Tie, Trousers, and Veil. To this set, manifold extensions can be made, by (i) studying literature, such as encyclopedia like the dictionary of costumes and fashion [12] or fashion magazines like Vogue [7], and (ii) by analysis of costumes and clothes frequently used in films. For example, further costume primitives that could be added based on fashion magazines are Boxers, Bra, Briefs, Cardigan, Glasses, Flip Flop, Hoodie, Pantie, Polo, Sweater, Socks, and Undershirt. Regarding film analysis, the identification of the Wild West Sheriff pattern revealed further costume primitives not contained in the initial set. These are Ammunition Belt, Belt, Boots, Holster, Neckerchief, Pocket Watch, Revolver, Spurs, Union Suit, Wild West Vest, Wild West Hat, and Wild West Tie. The identification of the Wild West Outlaw additionally contributed Chaps and Suspenders. The set of costume primitives can be further extended, given that the distinction between costume primitives and props is not always clear. Props can become a costume primitive when they are related to a costume in a strong way. For example the Ammunition Belt is an important part of the Sheriff costume, but it can also be seen as a prop because the actor often takes it on and off and uses it on screen, which also classifies it as a prop.

However, completeness of the set of costume primitives will likely be never achieved. The main reason for this is the incredibly large base of information that would need to be analyzed. Moreover, it makes a significant difference on which literature, fashion and lifestyle magazines, or films the identification of

costume primitives is based. Thus, our approach is to specify new costume primitives only when they are needed to describe a costume pattern. Another aspect of the costume primitives is the degree of detail in which they are described. For example, Barthes [2] provides a lot of details about properties of the clothes, like size, softness, and flexibility of certain material. Due to the level of abstraction that we chose for the description of costume primitives we do not go into further detail here. It is up to future research to find the right degree of granularity and abstraction for a costume primitive.

Figure 6 shows the format of costume primitives, containing the attributes *Name*, *Icon*, *Context*, *Description*, and *Additional Information* to serve the needs of different stakeholders. The time that is needed to document a costume primitive depends on the details provided in the description. We use the same definitions of attributes in costume primitives and costume patterns. Details about the attributes are given in Section 5. Using a subset of attributes allows converting a costume primitive that turned out to be a solution to a significant costume design problem into a costume pattern. For example, a Sheriff's Star could be seen and modeled as a costume primitive. However, thorough analysis of Western films revealed that the Sheriff's Star is the most significant property to recognize a role functionally as a law enforcement officer. This qualifies the Sheriff's Star as solution to a frequent costume design problem. It can be used in other compositions though. For example, the Wild West Sheriff composes the Sheriff's Star pattern with a particular constellation of Wild West clothing. We argue that the discrimination of the simple types in our approach, i.e. the costume primitives, and the complex types, i.e. the costume patterns, needs to be performed by a domain expert.
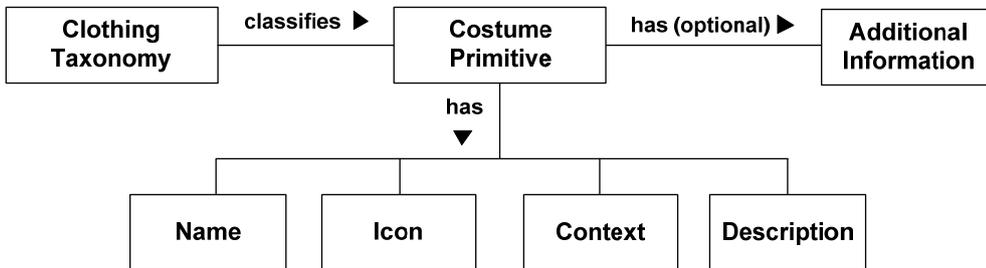

Figure 6: Conceptual model of costume primitives.

We further propose to use a clothing taxonomy to classify each piece of clothing. A simple sketch to illustrate such clothing taxonomy is provided in Figure 7. The purpose of the classification is to ease search in a catalog of costume primitives and to easily find related primitives. For example, if a particular hat in a costume rental catalog is classified as Cowboy Hat in the clothing taxonomy, a search for Wild West Hats will show it as result.
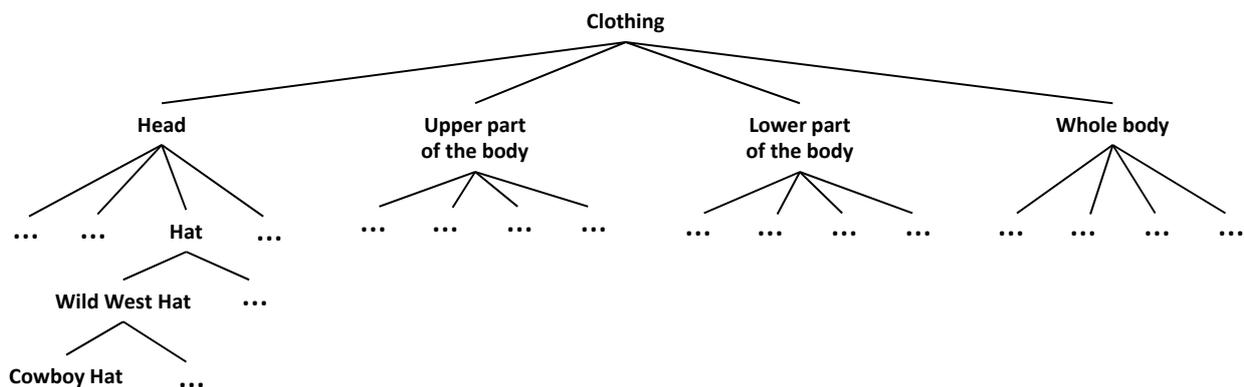

Figure 7: Sketch of a clothing taxonomy.

5 Costume Pattern Format

In our former work [1] we proposed a preliminary pattern format to illustrate the pattern approach in costume management. The pattern format oriented itself on the architectural patterns by Alexander et al. [5] and the Enterprise Integration Patterns by Hohpe et al. [6]. In the course of our further work with the costume pattern approach, we had to perform several changes to this format to account for insight in applying this format in practice. The basic attributes of the format were *name, icon, context, sub-patterns, application*, and *related patterns*. We replaced the *sub-patterns* list through *composition*. The *composition* is the main solution aspect of a pattern, revealing the inner structure of the constituent parts of a costume solution and the way the parts are composed. A composition graph, that can be used to describe the composition, is based on the composition operators we identified so far. Further, we have added the attributes *purpose* (which resembles the attribute *problem* that is used in most pattern languages), *description, examples, application, sewing templates* and *aging instructions*. As this format is rather large, we distinguish aspects of a pattern which we consider 'timeless' in terms of Alexander [10] and aspects which focus only on information needs of particular stakeholders of the pattern ('additional information'), see Figure 8.
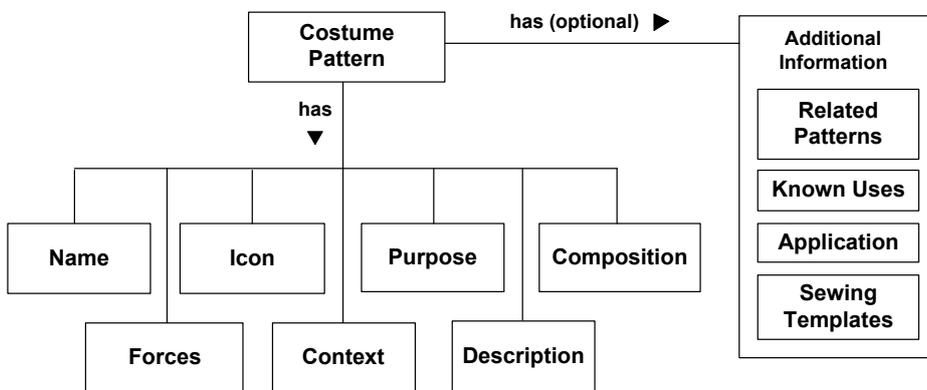

Figure 8: Conceptual model of costume patterns and their main constituents.

The pattern format now comprises the following core attributes:

- **Name**: For readability each costume pattern is given one or more names that specify the concept that the pattern represents. To ease readability technical identifiers are omitted in this paper.

- **Icon**: Each costume pattern contains one or more graphical icons that sketch the costume pattern. An icon may either be a drawing, a computer-created figure, or a photo.

- **Purpose:** The vestimentary message that the costume pattern transports.

- **Composition**: Often the structure of a costume pattern is a complex composition out of costume primitives and other costume patterns. The composition contains (i) a set of all elements, (ii) the operators used to compose the parts, either described textually or as composition graph, and (iii) optionally a recommended composition order. The elements are identified by name, id, or icon. The operators can be described textually or through a more formal description, for instance through process fragments [28]. The composition is a very important aspect of a costume pattern as it explains how the different aspects are working together, i.e. how single pieces of clothing are set into a complex relation.

- **Forces:** Forces reflect interpretations and reasons for the composition design of a costume pattern. Forces of a costume pattern are defined by the suspense of the diegetic world. That means each character and each costume is related to several terms and conditions that are part of the cinematic world they occur in. Thereby they represent the main results of media-scientific research.

- **Context**: For each costume pattern the context states 'where' (area), 'when' (epoch/ era/ period), and in 'which genre' it is usually applied. Multiple entries can be stated here.

- **Description**: The description characterizes the costume pattern itself and the stereotypes it comprises. We consider usage of ontology as quite useful here, with respect to usage in information systems.

In addition to the 'timeless' attributes described above additional information is useful for some scenarios.

- **Additional Information**: This optional set of attributes contains information artifacts annotated to the pattern.

    o **Related Patterns:** This attribute provides references to costume patterns that are related, e.g. through the genre, epoch, stereotype etc.

    o **Known Uses**: Examples of the application of the costume pattern can be provided through photos and references to films, film scenes, theatre plays etc.

    o **Application:** This attribute describes different procedures associated with the costume pattern for its application in practice. This may contain (i) dressing instructions, i.e. a description how and in which order to dress an actor with a complex costume following this pattern. Further, (ii) preparation instructions, i.e. procedures related to preparation for a scene like aging and cleaning of the costume are covered here, informally as plain text or formally in form of process fragments.

    o **Sewing Templates:** To support tailoring of costumes, sewing instructions in form of sewing templates can be added. This attribute is more important to costume primitives, rather than to costume patterns.

6 Composition Operators

As noted in the introduction, we understand the composition operators as a grammar to compose costume primitives and costume patterns to more complex structures. In the process of modeling the Wild West Sheriff costume, we identified several operators, which are required to describe how its constituent parts are connected to each other.

An operator can technically be described by a 5-tuple *O = (Source, Target, Type, Multiplicity, Details)*, where:

- *Source* and *Target* identifies a costume primitive, a costume pattern, or an ad-hoc grouping of clothing elements.

- *Type* identifies the operator that connects the *Source* to the *Target* (written <<verb-preposition>>).

- *Multiplicity* states the cardinality relation between the *Source* and the *Target* (written c1:c2, where c1 and c2 may be one of these cardinalities: 1, n, 0..1, 1..n, n..m, where n and m are natural numbers).

- *Details* contains description and annotations beyond the abstract description of the operator type, for instance text, process fragments which explain how to apply them, sketches or photos.

The operators we identified during modeling the composition structure of the Wild West Sheriff costume pattern are listed in Table 1. When the film corpus is extended or further complex costumes are investigated, there is most likely the need to add further operator types. Therefore, we do not see the presented set of composition operators as final, but extensible. Even more types of operators can be identified in real life when dressing oneself, or in the working practice of costume designers and dressers. Multiple operators can be used at the same time to connect two elements.

Operator	Description	Example
Attached-to	The source element is attached to the target element, so that it is visible on its surface.	A Sheriff's Star is attached to a vest.
Belted-on	The source element is belted on the target element.	A leather belt is belted on a pair of trousers
Hooked-in	The source element is hooked in the target element.	A pocket watch is hooked in a vest
Tied-around	The source element is tied around the target element.	A neckerchief is tied around a shirt.
Tucked-in	The source element is tucked in the target element.	A shirt is tucked in trousers.
Worn-above	The source element is worn above the target element, thus the target element has to be applied first.	A vest is worn above a shirt.
Worn-on	This operator is required to express which elements are worn with direct physical contact.	A hat is worn on a Sheriff's costume.

Table 1: Overview of composition operators.

Besides these composition operators, there is also a need to express logical connectives between elements in a grammatically valid way. Through such connectives, variants of a composition can be captured in the composition graph. For the Wild West Sheriff pattern however, the 'or' operator was already sufficient, see Table 2. Further connectives to extend the costume pattern language are likely to be required in further modeling of complex costume patterns, like 'only-if'.

Connective	Description	Example
Or	The 'or' connective is required to express composition variants. It represents a logical operator (here: either... or... / XOR).	Either a neckerchief or a tie, but not both of them at the same time.

Table 2: Overview of composition connectives.

For a more tangible and easy-to-read description, we created a simple graphical notation to describe compositions. An operator is represented by an arrow, labeled with the operator type that is used. It is drawn from one costume pattern icon to another to indicate the elements of the connection. The arrow-head represent the target, its origin the source. Figure 9 illustrates how the graphical notation can be used, attaching a Sheriff's Star to a vest.
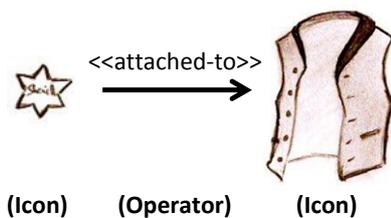

(Icon)   **(Operator)**   **(Icon)**

Figure 9: Example for graphical composition.

In our graphical notation the 'or' connective does not have any arrow-head, because a subject or object cannot be distinguished anyway, see for example the operation on choosing either a neckerchief or tie depicted in Figure 10.
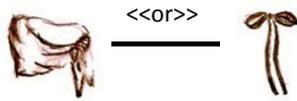
Figure 10: Example for usage of a logical composition operator to express variants.

The use of multiplicity allows specifying in a composition, how many pieces of an element are required. Normally, the multiplicity is 1:1, meaning for instance there is one Sheriff's Star required to be attached to one vest. This default multiplicity is not shown on the operator arrows. If the multiplicity however differs from that default, it is shown explicitly, as exemplified in Figure 11: A pair of boots consists of a left and a right boot. One spur is belted on each of them. Thus, the multiplicity is specified as 2:1 (it reads from the source to the target). Through this concept, it can also be specified, that particular elements are optional using the style common in information modeling: 0:1 stands for cardinality zero or one.
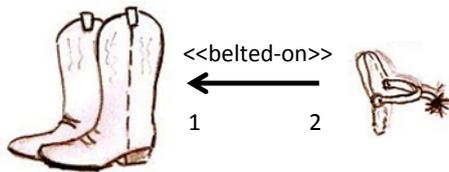

Figure 11: Example for usage of a multiplicity to express variants.

In order to account for more fine-grained elements than on the level of granularity we proposed, one could use 'composed-of' as an additional operator type. A vest, for instance, actually consists of parts like a (left and right) front part, back part, front collar, back collar, pocket and pocket braiding. We considered this level of granularity in the annotations part, in which corresponding sewing templates are placed. When using such an operator, compositions could be described much more fine-grained. This, however, increases the degree complexity of the composition graphs.

7 Examples of Costume Primitives

In the following, we provide the description of three costume primitives we found in the context of Western films, the 'Wild West Vest', the 'Wild West Boots', and the 'Cowboy Hat'.

7.1 Wild West Vest

Name: Wild West Vest

Icon:

Figure 12: Icon for the Wild West Vest.

Context: The Wild West Vest is mainly used for Sheriffs, Cowboys, Ranchers, and Bandits around the Pioneer era (mid to late 19th century) in Western North America; Main genre: Western.

Description: A Wild West Vest is an upper part of clothing without sleeves. It mainly consists of a front and back part, collar, bound pockets and some buttons. When the vest is worn as a part of a suit then it should be made out of the same fabric as the suit. Most recommended materials for a Wild West Vest are leather, jeans or other robust fabrics available in the mid to late 19th century.

15

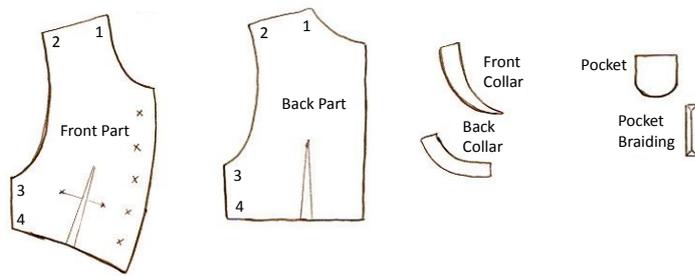**Additional Information**

Templates for sewing:

Figure 13: Templates for sewing, which are annotated to the Wild West Vest.

7.2 Wild West Boots

Name: Wild West Boots

Icon:

Figure 14: Icon for the Wild West Boots.

Context: The Wild West Boots are mainly used for Sheriffs, Cowboys, Outlaws, and Ranchers around the Pioneer era (mid to late 19th century) in Western North America. Next to the original use as riding boots the Wild West Boots became a sign for American culture and are found in different actual styles; Main genre: Western

Description: Wild West Boots are a specific type of footwear. They are a special sort of riding boots, which cover foot and ankle, and extend up the lower leg. Wild West Boots can be distinguished by their high heel compared to other male shoes, their pointed toe, and their lack of lacing. Traditionally made of leather, the Wild West Boot is characterized by typical embellishment.

7.3 Cowboy Hat

Name: Cowboy Hat

Icon:

Figure 15: Icon for the Cowboy Hat.

Context: The Cowboy Hat is mainly used for Sheriffs, Cowboys, Outlaws, and Ranchers around the Pioneer era (mid to late 19th century) in Western North America. Nowadays it is still worn by many people like ranch workers in the USA, Canada or Mexico, participants at the rodeo, or country music singers. Since its date of origin the Cowboy Hat is related to associations like freedom, adventure, virility, and loneliness. It has a confirmed place in western culture. Main genre: Western

Description: The Cowboy Hat is a type of hat that originates in the Pioneer era in Western North America. The Cowboy Hat can be identified by his high crown, a wide brim that is bent up, and a leather or rip ribbon

around the crown. The material an original Cowboy Hat is made of is the beaver fur, which gives the hat its special shinny soft-felt look. It was developed to protect the wearer of weather circumstances while working outside or riding. Because the Cowboy Hat is worn outside and typically for a very long time it often gets modified by the special needs of the wearer like bending the brim in a way that water will not run into the face of the wearer during rain.

8 Costume Pattern: The Wild West Sheriff

Name: Wild West Sheriff

Icon:

Figure 16: Icon of the Wild West Sheriff pattern.

Purpose: The Wild West Sheriff costume stands for a man of law working in a town in the Wild West.
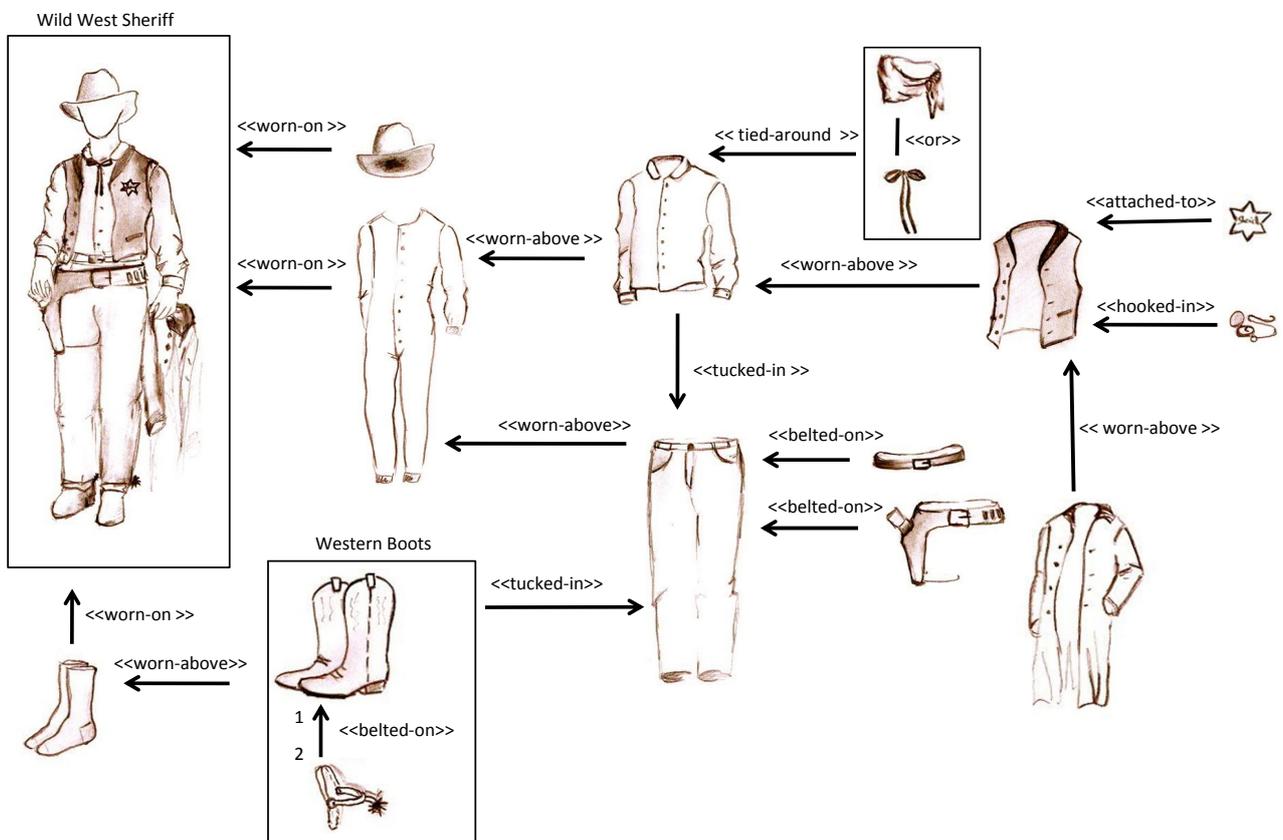
Composition:

Figure 17: Composition graph of the Wild West Sheriff pattern.

Composition elements: The costume consists of the following costume patterns: Union Suit, Shirt, (Wild West Tie or Neckerchief, specified as 'ad-hoc' group in the composition graph), Wild West Vest, Sheriff's Star, Pocket Watch, Pair of Trousers, Belt, Ammunition belt, Socks, Wild West Boots (spurs belted on boots), Coat, and Hat.

Recommended composition order: 1. Union Suit, 2. Shirt, 3. Pair of Trousers, 4. Belt, 5. Wild Vest, 6. Sheriff's Star, 7. Pocket Watch, 8. Wild West Tie or Neckerchief, 9. Socks, 10. Boots, 11. Spurs, 12. Ammunition Belt, 13. Coat, 14. Cowboy Hat.

Forces: The role of the Sheriff stands for the man of law in his town. Therefore he is wearing a Sheriff's Star, which is the symbol of law and order and the official sign of being a person of law who takes care of the police duties of the town. In being a respected person in his town he is considered to be related with garments that match a character that is behaving controlled, grown up and sorted. For example the Wild West Tie, the Watch and the Coat demonstrate this. Especially the cut of the Coat is associated with a military coat and relates the inherent values like neat, fair and lawful to its wearer.

Context: The Wild West Sheriff occurs around the Pioneer era (mid to late 19th century) in Western North America; Genre: Western.

Description: The role of a Wild West Sheriff represents a law enforcement officer. The Wild West Sheriff is responsible for a particular county.

Additional Information

Related Patterns: Modern Sheriff, Fantasy Sheriff, Cowboy, Indian, Outlaw, and Rancher.

Known Uses: John Wayne as John Chance in Rio Bravo (1959); Gary Cooper as Will Kane in High Noon (1952); George Bancroft as Marshal Wilcox in Stagecoach (1939).

Application:
Dressing instructions (textual): Dressing instructions follow the recommended composition order. The buttons of the shirt have to be closed, the sleeves of the shirt are mostly worn long, but there are some characters with willowed sleeves. A Wild West Sheriff wears his shirt tucked in the trousers, while the trousers are worn either above the boots (usually) or tucked inside.

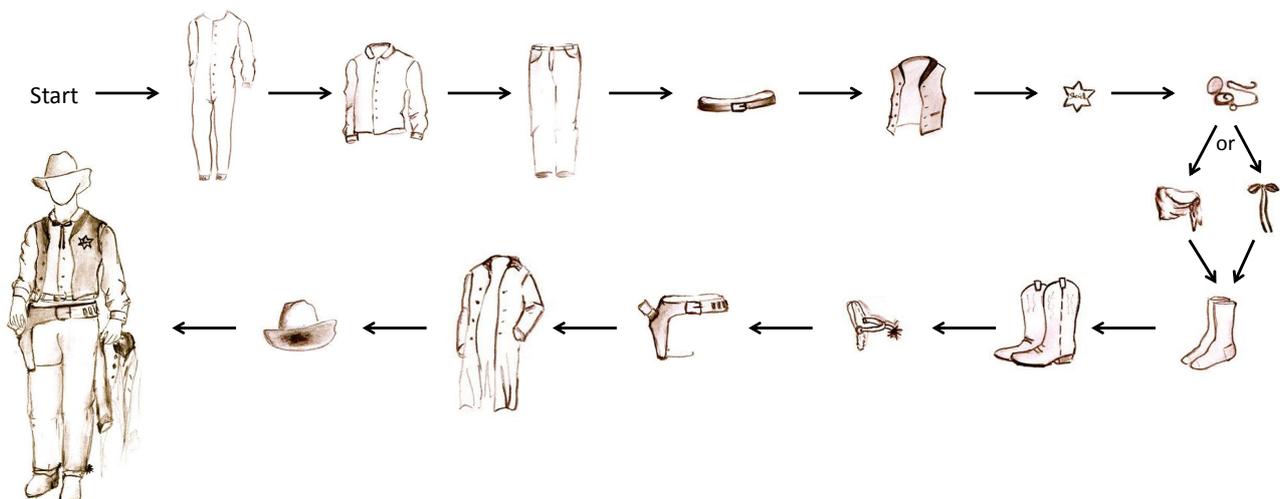*Dressing instructions (graphical)*:

Figure 18: Graphical dressing instructions to support costume usage in practice.

Preparation instructions: For preparation the costume needs to be checked for completeness. Then, cleanness and aging can be checked. Aging, which means giving character or 'patina' to a costume element, refers to preparing dirt or dust on boots, trousers, coat and hat; the shirt can be aged with water for simulating sweat. Then, applying the belt on the trousers; setting time of the pocket watch to time in the film

scene and hooking it on the vest; preparing the knot of the tie; belting spurs on the boots, and laying socks on the boots.

Variants: The vest is most of the time worn open, only the very neat characters are seen with a closed vest. Characters may vary in some details, e.g. some wear a neckerchief instead of the tie (usually), a long sleeve t-shirt instead of a shirt, or a shirt with an application at the front. Also the ammunition belt can vary in having one or two revolvers attached to it. Sometimes the trousers are tucked in the shoes, worn above, or even rolled up.

9 Costume Pattern: The Wild West Outlaw

Name: Wild West Outlaw

Icon:

Figure 19: Icon of the Wild West Outlaw Pattern.

Purpose: The Wild West Outlaw costume states that the role who is wearing it is the troublemaker of a town in the Wild West. Not being part of the community life of the town, the Wild West Outlaw invades the town and causes danger.
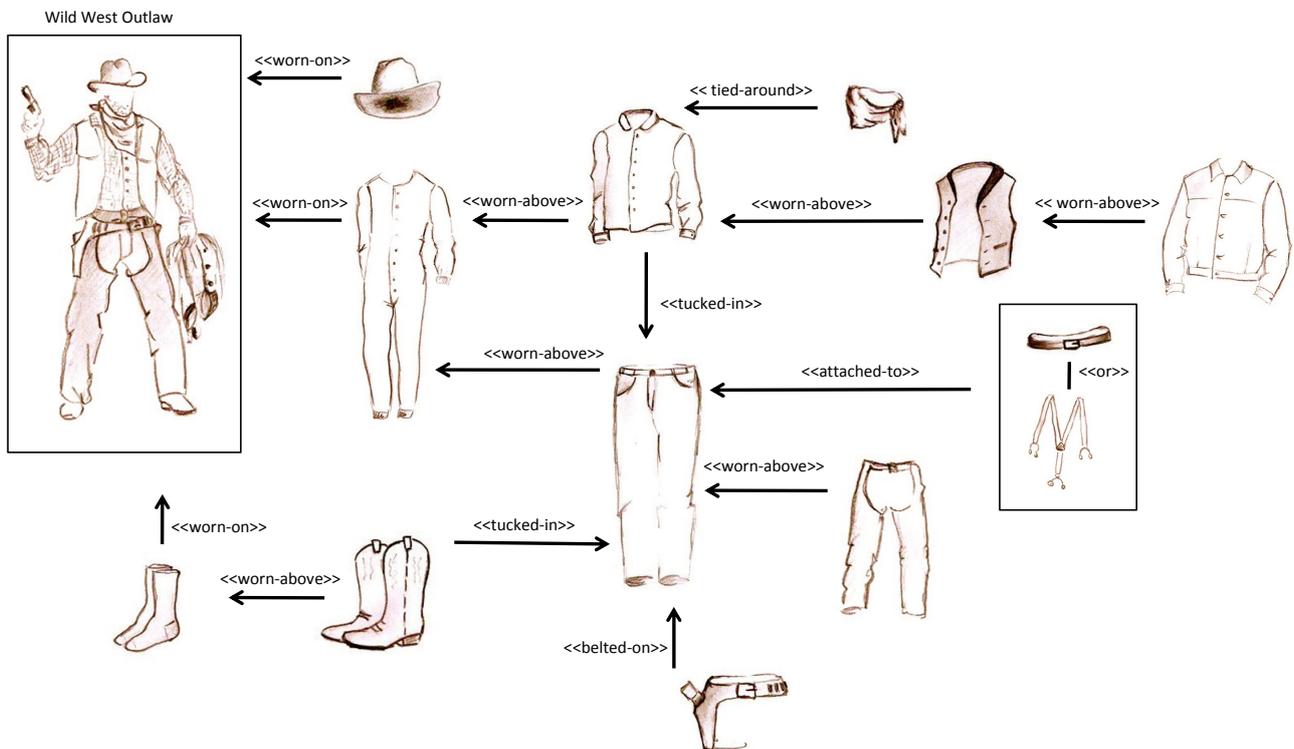
Composition:

Figure 20: Composition graph of the Wild West Outlaw pattern.

Composition elements: The costume consists of the following costume primitives: Union Suit, Shirt, Neckerchief, Wild West Vest, Pair of Trousers, Chaps, Belt or Suspenders, Ammunition Belt, Socks, Wild West Boots (optionally with Spurs), Jacket, and Hat.

Recommended composition order: 1. Union Suit, 2. Shirt, 3. Pair of Trousers, 4. Belt or Suspenders, 5. Chaps, 6. Wild West Vest, 7. Neckerchief, 8. Socks, 9. Boots, 10. Ammunition Belt, 11. Jacket, 12. Hat.

Forces: Because the Wild West Outlaw is coming as a troublemaker from the plains to the town, his clothes are usually already worn for a long time and quite dirty. He is expelled from the community life of the town and lives on a horseback most of the time. This can be communicated through the Chaps. Other specific costume primitives like the Jacket and the Suspenders are related to a person who seems less distinguished and less grown up. In this spirit the cut of the Jacket in the Wild West Outlaw pattern is less formal, less accurate, and associated with youth.

Context: The Wild West Outlaw occurs around the Pioneer era (mid to late 19th century) in Western North America; Genre: Western.

Description: The role of a Wild West Outlaw represents the antagonist to the Wild West Sheriff. He resides outside the law and terrorizes the townspeople by stealing, raping and killing.

Additional Information

Related Patterns: Wild West Sheriff, Barman, Saloon Girl, Cowboy, Modern Outlaw, and Biker.

Known Uses: Tom Tyler as Luke Plummer in Stagecoach (1939); Sheb Wooley as Ben Miller in High Noon (1952); John Russell as Nathan Burdette in Rio Bravo (1959).

Application:
Dressing instructions (textual): The topmost buttons of the shirt are often worn open and the sleeves of the shirt are mostly worn long. A Wild West Outlaw wears his shirt most of the time tucked in the trousers, while the trousers are worn either above the boots or tucked in. To secure the trousers a belt or suspenders are applied, sometimes both. The west is worn open while the neckerchief gets tied around the neck or the nose to cover the face.
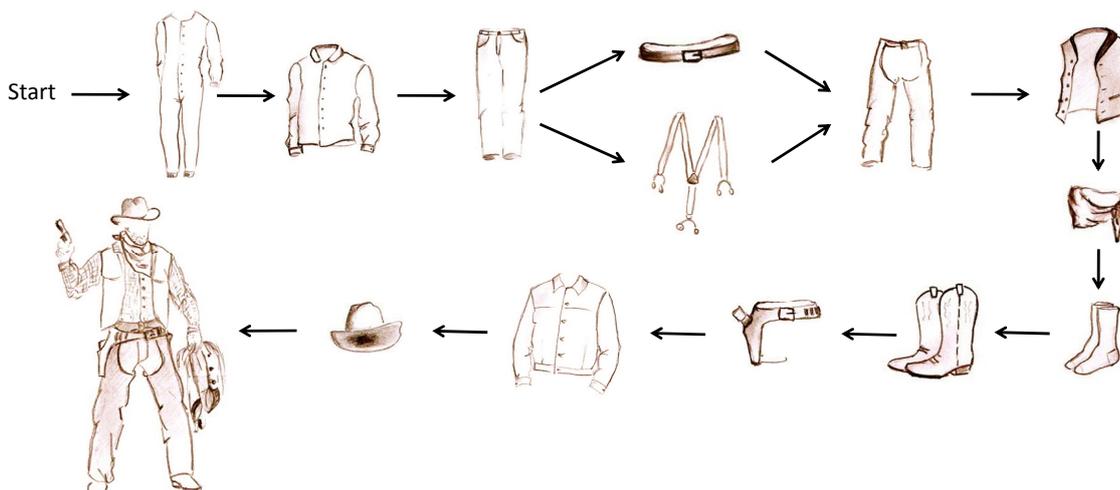
Dressing instructions (graphical):

Figure 21: Graphical dressing instructions of the Wild West Outlaw pattern to support costume usage in practice.

Preparation instructions: The costume needs to be checked for completeness and especially its state of aging (usually: quite dirty, worn for a long time). Then belt or suspenders can be applied to the trousers, as well as the knot of the neckerchief can be prepared and the socks can be laid on the boots before the actor gets dressed.

Variants: There are different occurrences of Wild West Outlaws like the head of the outlaws or one of his

accomplices. They also vary in the costume. Most of the time the Wild West Outlaw in higher position is presented without the chaps, wearing the tie instead of the neckerchief, being more tidy than the others. Also, there can be found a wide range of weapons including knifes, revolvers, and rifles carried by the Wild West Outlaw. When looking at the concrete costumes from which the pattern originates, there are several differences in the cut of clothes and in their specific way of wearing. For example, several types of shirts can be found and several different ways of wearing them, like buttoned up or leaving a few buttons open, tucking it in the trousers or wearing it on top of them etc. The pattern captures the most common way.

10 On Differences and Commonalities of Patterns

Having a set of costume patterns ready, further analysis can be made based on the differences and commonalities in the different pattern attributes and composition structures. For example, a relationship diagram can be created that shows the relations between different patterns and how they fit into a particular context. Figure 22 shows how such a diagram might look like. Starting from a general category, Wild West from mid to late 19th century, we can distinguish between male and female roles. Within the category of the male role we identified the Wild West Sheriff and the Wild West Outlaw. They relate to each other as 'Antagonist'. Many further patterns can be identified in the genre and the relations between them can be used to create a graph with lots of information to reason about.
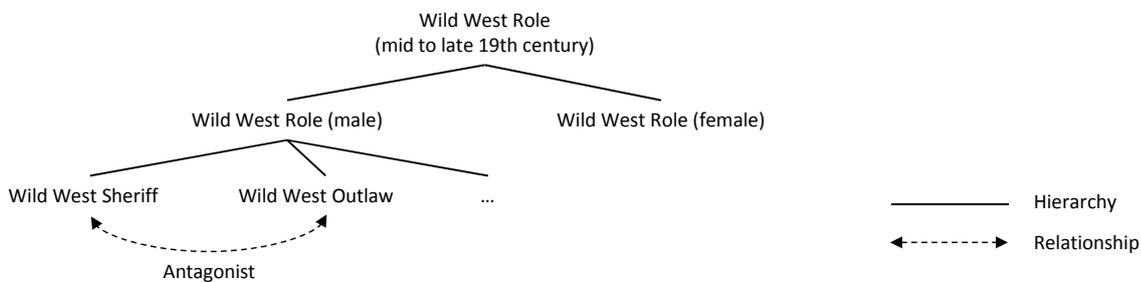

Figure 22: Relations between costume patterns

Furthermore, through an in-depth analysis and comparison of composition structures we are able to generate new knowledge about costumes. In the following we show one exemplary analysis, which we call 'confrontation'. For this analysis we merge the composition graphs of the Wild West Sheriff and the Wild West Outlaw. Based on this merged graph, we apply color-coding to highlight the differences of the Wild West Sheriff (in blue) and the Outlaw (in red). Commonalities are depicted in grey. Figure 23 shows the outcome of the merge and color-coding which can be interpreted in terms of costume primitives and forces.

The specific costume primitives of each role, as highlighted in blue and red in Figure 23, are closely related to the characteristics of the stereotype role they are part of. As described in the pattern forces already the Sheriff's Star is the symbol of law and order and thus it could never be found in the Wild West Outlaw pattern. On the other hand, the Sheriff is a citizen of the town, whereas the Outlaw is expelled and lives most of the time on a horseback and therefore needs the Chaps. When taking a closer look at the costume primitives which are only found in the Wild West Sheriff pattern like the Wild West Tie, the Watch, and the Coat, one can conclude that these garments are considered to be related with a character that is behaving controlled, grown up and sorted. The Wild West Outlaw pattern with specific costume primitives like the Chaps, the Jacket and the Suspenders seem less distinguished and less grown up. This vestimentary communication provides the recipient already with a lot of information about the characters, without the need to transport this information in spoken language. In showing the differences and commonalities of the two patterns as depicted in Figure 23, some parts of a 'vestimentary code' become obvious.
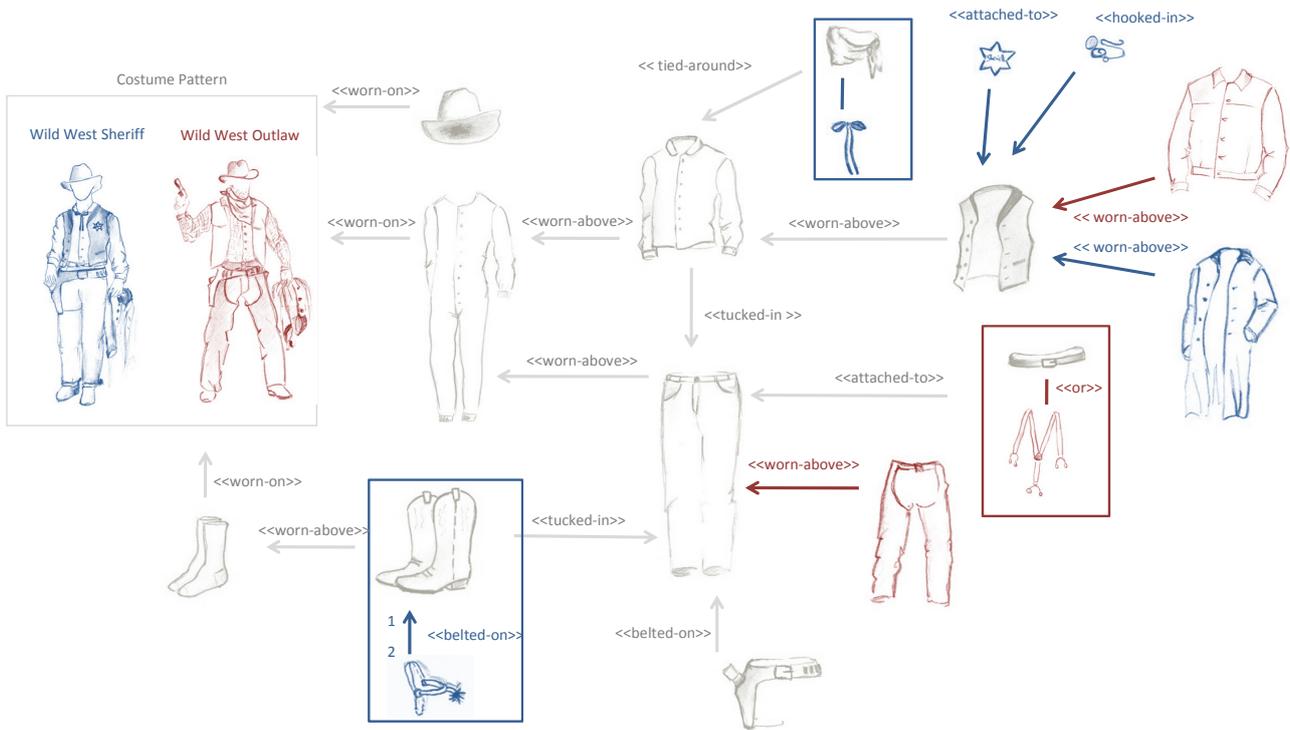
Figure 23: Differences and commonalities of the Wild West Sheriff and the Wild West Outlaw.

We can apply abstraction and generalization to obtain a more general costume, the Wild West Role (male), see Figure 24. Such a 'generalized' costume can be used in many different ways. One way is to use it as a template for costume design, to accelerate the design process. Another way is to use it as query to be executed against a costume catalog offered by a costume rental and shop to get a first offer that can be refined in a next step. In addition, such generalized costume structures can be used to design characters which fit into a particular film context without indicating their function. Further investigation of analysis methods is just one aspect of our future work in this field.
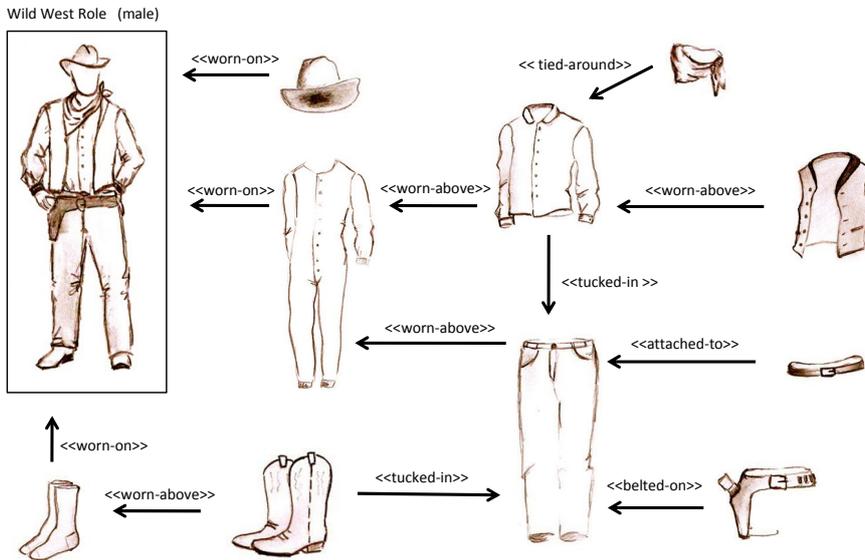

Figure 24: By abstracting from the details of a Wild West Sheriff and a Wild West Outlaw we obtain a generalized Wild West costume: the Wild West Role (male).

By reducing all the variations and different possible ways a certain character can be dressed, abstraction into a pattern allows thorough comparison to enable making general statements about the vestimentary conventions in films. However, this abstraction also means reduction. The constituent parts of the patterns are supposed to be linked to a clothing taxonomy to ease the selection of real pieces of clothing when

creating a concrete costume in order to not lose the different variations of costumes. This does not mean that there is only one concrete costume possible to realize the solution sketched by the pattern. In fact, the pattern provides the user with a suggestion that needs to be interpreted and applied in a creative and innovative manner for every film and every character. In designing a costume, the costume designer oscillates between stereotype elements on the one hand and individual elements, changes, and refinement on the other hand. The stereotype elements are important for the understanding of a character while the individual elements make a character authentic. The patterns show the pure stereotype elements that everyone understands. Variations in color, material, design, and size can show individualization related to a certain figure.

11 Conclusion and Outlook

In this paper we presented a pattern language to capture knowledge of costume design for films. We followed a clearly described research design to obtain the different components of the language – a format for costume primitives and costume patterns, a set of costume primitives and costume patterns, and composition operators for modeling complex costumes. We exemplified the components along different examples to illustrate the key concepts and findings. Based on the developed pattern approach some media-scientific statements can be made. In having an initial format to capture the vestimentary code of films it is possible to show the conventions that have been developed between the use of costumes in films and their understanding by the recipient. As exemplified in the previous section, the comparison of the identified patterns makes the specifics of a certain role clearer. This formal approach based on a pattern language allows an empirical analysis of costume usage. Through this pattern-based approach we would like to address the problem of finding a costume language that allows overall statements on the use of costumes in films.

However, from a practical point of view the question remains if and how well identified costume patterns are applicable in practice, i.e. in other films. Although the costume patterns describe the core of a solution to a costume design problem, their application in a particular film for a particular character and actor, etc. demand a lot of decisions. For instance, concrete fabrics have to be chosen for the costume primitives used in a costume pattern. In addition, depending on many different influencing factors, a costume designer may need to make changes and extensions when applying a costume pattern in costume design. Further investigation is required to find out how the pattern language needs to be modified or extended to efficiently support this decision making and to ease and fasten the regular way of creative working with costume designs in practice. Evaluation through domain experts and subsequent improvement of the pattern format and the graphical composition notation is another important task in our future work.

From a research point of view, some aspects require further exploration before building such a supporting information system. Two of them are shortly described in the following: (i) so far we only modeled operators that compose the different elements of a costume. However, further connections beyond the composition operators are conceivable to be defined, for instance 'same-color', 'different-color', or 'same-fabric'. Such connections do also have an impact on decision making when applying the costume pattern in practice. Because the used film corpus contained a few black-and-white films the color aspect has not been considered yet and requires further investigation; (ii) most challenging from a research point of view are advanced usage scenarios exploiting the information that is contained in the pattern description and in the additional information provided for it. For example, the dressing instructions have been modeled explicitly, based on best-practice in dressing at a film set. Possibly, such dressing instructions can also be generated automatically. If there is no best-practice information available for a costume yet, a possible solution could be proposed on the fly. However, not all operations in our current composition grammar imply dressing dependencies and thus further investigation is required for generation of dressing instructions from a composition graph.

To conclude, we aim at enabling a new branch of research, which opens many new questions, but also provides a lot of new answers to questions never asked before. We change the setting of patterns well-known in architecture and programming to a new area, crossing stakeholders and disciplines by applying patterns and modeling technology to film costumes. Our approach focusses on film productions, but is not limited to this scope. Possibly, it can even be used as a basis for research on formalizing fashion and clothing thinking in order to enable analysis of day-to-day vestimentary communication.

About the Authors

The author team of this work is composed of researchers and practitioners from different disciplines. On one side, David and Frank are working in computer science research. Frank has been working in software industry for over two decades; David is currently finishing his Ph.D in computer science, focusing on business process technology. Both contribute to the paper as experts from the domain of computer science, information technology, and language design. On the other side, Johanna and Lutz are coming from the media science domain. Lutz is an expert in the domain of media science research, with focus on the field of media and communication theory and the social impact of information technology. Johanna studied costume design at an international film school and worked in several film productions in the costume department in different roles. At the film school she worked with several renowned costume designers. Johanna contributes to the paper as a domain expert in costume design, film making, and media science. This interdisciplinary team provides the domain knowledge to leverage the pattern approach for costume design considering the possibilities of information technology.

References

1. J. Barzen, F. Leymann, D. Schumm, M. Wieland: Ein Ansatz zur Unterstützung des Kostümmanagements im Film auf Basis einer Mustersprache (in German). In: Proceedings of Modellierung 2012, Gesellschaft für Informatik (GI).

2. R. Barthes: Die Sprache der Mode (in German) [Système de la Mode 1967]. Frankfurt/M, 1985.

3. N. B. Harrison: Advanced Pattern Writing. In: Proceedings of the 8th European Conference on Pattern Languages of Programs (EuroPLoP), 2003.

4. D. Schumm, J. Barzen, F. Leymann, M. Wieland, L. Ellrich: Business Process Automation for Costume Management in Film Making: An Insight into Processes, Roles, and Document Structures. In: EMISA Forum 32(1):26—47, 2012.

5. C. Alexander, S. Ishikawa, M. Silverstein, M. Jacobson, I. Fiksdahl-King, S. Angel: A Pattern Language: Towns, Buildings, Constructions. Oxford University Press, 1977.

6. G. Hohpe, B. Woolf: Enterprise Integration Patterns. Addison-Wesley, 2004.

7. Condé Nast: Vogue, 2012. Online available at http://www.vogue.com

8. R. Burger: Contemporary Costume Design. Dress Codes und weibliche Stereotype im Hollywood-Film (in German). Wien 2002.

9. U. Zdun, P. Avgeriou: Modeling Architectural Patterns Using Architectural Primitives. Proceedings of the 20th ACM Conference on Object-Oriented Programming, Systems, Languages & Applications (OOPSLA), 2005.

10. C. Alexander: The Timeless Way of Building. Oxford University Press, 1979.

11. M. Walsh: The Democratization of Fashion: The Emergence of the Women's Dress Pattern Industry. In: The Journal of American History, Vol. 66(2):299–313, Organization of American Historians, 1979.

12. C. Wisniewski: Kleines Wörterbuch des Kostüms und der Mode (in German). Reclam, 1999.

13. BurdaStyle: Sewing Patterns. 2012. Online available at http://www.burdastyle.com/patterns

14. The McCall Pattern Company: Vogue Patterns, 2012. Online available at http://voguepatterns.mccall.com/

15. go_disco*: actorsBreakdown, 2011. Online available at http://www.go-disko.com/products/index/2

16. FRT Consulting GmbH: ProFundus, 2011. Online available at http://www.frt.at/produkte/profundus/

17. University of Rhode Island: Commercial Pattern Archive (CoPA), Online available at http://www.uri.edu/library/special_collections/COPA/sample.php

18. P. Flynn: Body Language – The Language of Contemporary Fashion. Yale-New Haven Teachers Institute, 2010.

19. D. Bordwell, K. Thompson: Film Art: An Introduction, New York, 1980.

20. S. Bruzz: Undressing Cinema. Clothing and Identity in the Movies. London/New York, 1997.

21. J. Gaines, C. Herzog: Fabrications: Costume and the Female Body, New York, 1990.

22. A. Giannone: Kleidung als Zeichen. Ihre Funktionen im Alltag und ihre Rolle im Film westlicher Gesellschaften. Eine kultursemiotische Abhandlung (in German). Berlin, 2005.

23. D. Davoucoux: Mode im Film. Zur Kulturanthropologie zweier Medien (in German). Bielefeld, 2007.

24. Costume Bot: Dressing a Stormtrooper, 2008. Online available at http://costumebot.com/archives/8

25. M. Keckeisen, S. Stoev, M. Feurer, W. Straßer: Interactive Cloth Simulation in Virtual Environments. In: Proceedings of IEEE Virtual Reality, IEEE Computer Society, 2003.

26. A. Fießer: A Pattern Language for Film Production. In: Proceedings of the 12th European Conference on Pattern Languages of Programs (EuroPLoP), 2007.

27. S. Seidel, M. Rosemann, A. ter Hofstede, L. Bradford: Developing a Business Process Reference Model for the Screen Business – A Design Science Research Case Study. Proceedings of the 17th Australasian Conference on Information Systems (ACIS'06), 2006.

28. D. Schumm, D. Karastoyanova, O. Kopp, F. Leymann, M. Sonntag, S. Strauch: Process Fragment Libraries for Easier and Faster Development of Process-based Applications. In: Journal of Systems Integration, 2(1):39–55, 2011.