Using soft systems methodology to improve the colour forecasting process

Tracy Diane Cassidy and Tom Cassidy

School of Design, University of Leeds, Leeds, UK, LS2 9JT
Emails: t.d.cassidy@leeds.ac.uk; t.cassidy@leeds.ac.uk

Colour forecasting is a process where attempts are made to accurately forecast colour for fashion-related products that consumers will purchase in the near future, usually two years ahead. Seasonal colours are recognised as a powerful driver of sales. Currently trend forecasts are marketed and sold globally. The information is broad and generalised and does not take into account colour preferences. In the study the anticipation of consumer acceptance was identified as the weakness of the process and an improved system model was developed replacing the anticipation stage with consumer colour acceptance data. The improved model is considered highly beneficial for fashion-related industries to adopt in order to increase their competitiveness in the global market and to assist waste reduction (unwanted products) that impact on the environment. In this paper the development of the two models is presented and discussed in an attempt to purposely promote the usefulness of soft systems methodology for design research.

Published online: 28 March 2012

Introduction

Soft systems methodology (SSM) has become a widely-used tool for investigating and better understanding human activity situations. It evolved from earlier systems engineering approaches such as those used by Richard de Neufville and Joseph Stafford [1] and Stanford Optner [2-4]. The soft systems methodology was developed by Peter Checkland [5,6] and later with his associate Jim Scholes at Lancaster University [7,8]. While Checkland and co-authors have published further books on the subject [9] and its application [10], a more applied text was published by David Patching [11] which the authors consider to be more 'designer friendly'. While Joseph O'Connor and Ian McDermott [12] discuss the skills required for systems thinking and relate these to creative problem solving in the broader context of self-development as the methodology can be used to expose 'deeper patterns and connections beyond logical thinking', most authors discuss SSM and its application in a business sense, such as the works of Brian Wilson [13,14] and lately that of Russell Ackoff [15].

This paper shows and discusses the application of the soft systems methodology to uncover the colour forecasting process with a view to its improvement. In doing so, we further develop Patching's designer-friendly approach through the discussion of the methodology in the context of design with a particular emphasis on the often overlooked and under-valued rich pictures tool that offers a far-reaching and thoroughly engaging means of exploration for the creative designer. The methodology was used to explore weaknesses in the current colour forecasting process leading to the development of an improved process model. Through a survey undertaken to test and validate the models, our proposed improvement found favour with a large majority of respondents in the industry, who engaged regularly with the colour forecasting process as a fundamental part of their job role in either as a designer, buyer, or forecaster; thus leading to further research to develop the concept into a 'real world' activity discussed in the section entitled 'Real world / systems world comparison (Stage 5) later in the paper. In accordance with SSM, research continues to this day to develop suitable means to enable the improved model to exist in a manner that better suits the retailers critical path, this concept is further supported by a number of publications and outlined in the section entitled 'Action to improve (Stage 7)' towards the end of the paper.

The underlying philosophy

The methodology is based upon seven identified stages that can be used to appreciate and understand a subjective problem or situation holistically. Checkland [5] developed the system for business research however the authors feel that the original thinking is sound for design process research as it essentially explores human activity. While each stage is important in its own right, it is generally not considered necessary to complete each stage fully before continuing on. Rather, it is possible, and indeed desirable to keep returning to particular stages in order to impose clarity to the situation as a whole. Also the tools of the methodology have value and can be used alone. The system has a specific language that needs to be understood by the system user. The terminology, the stages and the tools of the methodology will be explained throughout the paper while at the same time applying it to the colour forecasting process as an example of a problem state; in doing so, the authors attempt to further the design researcher's understanding of soft systems methodology and its potential in design research through discussion of the development, testing and refinement of the resulting models. Furthermore, a concise understanding of the colour forecasting process is given, its current limitations implicitly expressed and a potential real-world solution is presented.

Validity

Soft systems methodology is essentially an action research method that is used to educate through the seven stages as well as to conceptualise and, if necessary, to implement change. The method can therefore be viewed as an 'inquiry process' [16, p4-5]. Pala et al declared validity a minor issue due to the method being 'of a different type' where the validity of the representativeness of reality is useless' and that it is the 'well-groundedness' of the research, or the justification, that must be judged [17, p706]. This is because, as Checkland declared, the models are concepts based on world-views (weltanschauung) to be used to discuss the situation and how possible changes may affect that situation [18, p706]. It is therefore the validity of the research undertaken to inform the SSM process and the root definition can require scrutiny [19, p708]. The secondary information was taken from

texts written by reputable authors in the field of textiles, fashion and forecasting and verified with industrial personnel who work with the colour forecasting system to gain a consensus of agreement of the facts to deem the models 'well-grounded'. The same respondents validated the likelihood of the improved models being a justifiable future reality that would have a positive impact on the industry should it be implemented.

The soft systems model

The concept of soft systems methodology makes use of two key aspects; the problem as it is understood in the 'real world' and in the 'systems world'. Analysis and conclusions from the latter are then brought back into the 'real world' with a more substantial understanding of the problem and thus, possible routes to solutions. The diagram shown below in Figure 1 is an adaptation of Patching's [11 p41] interpretation of the seven stages of the method.

The first two sections of the methodology apply to the real world scenario of the problem, as seen by the researcher. This incorporates information previously sought to understand the problem, which is achieved through a key tool of SSM – rich pictures.

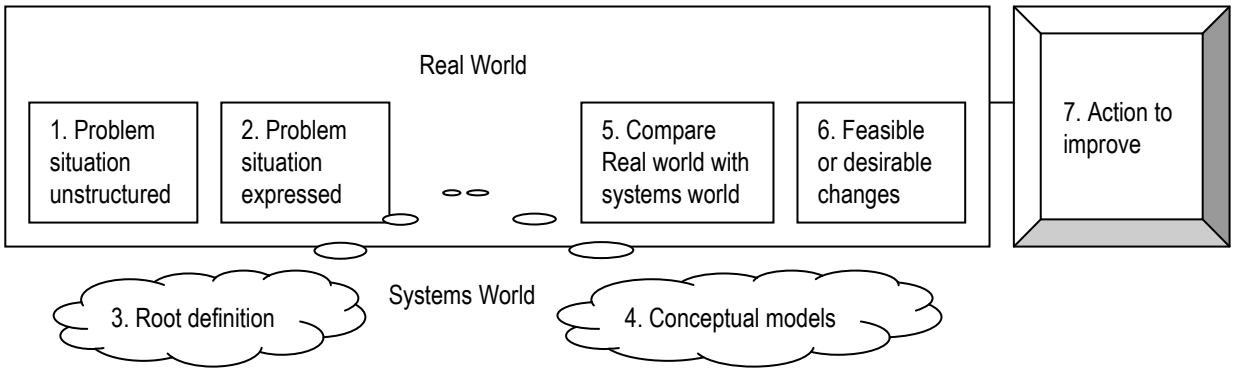

Figure 1: The 7 stages of SSM.

Rich pictures

Rich pictures are cartoon like drawings or sketches, illustrating the different aspects of the problem to be analysed. A series of drawings may be produced and later sanitised to remove any offensive material prior to presentation. In other words, if these pictures are to be shown to clients you do not want to offend them, even if it represents the truth. By collating individual drawings a rich picture of the situation holistically can be produced. While a time consuming exercise, it is a worthwhile approach and satisfying to the creative researcher. This holistic picture then serves as a tool to uncover the tasks and issues to be investigated. Rich pictures are a particularly attractive and an easily understood tool for creative people. While pictogram tools are currently available with pre-designed clip art type images [19] and are used by practitioners and those studying business, creating rich pictures yourself is a much more exciting and indeed an effective method for the creative researcher. All of the rich pictures shown in this paper were, incidentally, created by using only the drawing tools in Microsoft Word. This goes part of the way to demonstrate the simplicity of the rich pictures tool and the basic level of art or computer skills required to create such pictures. If the rich pictures are

only to be used by the researcher and not to be shown to others, then basic hand sketching is all that need be required. However, it is at the discretion of the individual how much time and effort is actually involved and the level of detail in the drawings. The authors suggest that investing time and creativity into this stage not only helps to build up a visual representation but also enables the analyst to get a good feel for the situation being studied.

Working with the SSM model

The systems world provides a place where the researcher can go to in order to experiment with the data and conceptualise a structure to an otherwise unstructured situation. This allows the use of soft tools such as intuition, inspiration and insight [20] and enables entry into altered states of mind figuratively, the worlds of the subconscious mind and even possibly, the super-conscious mind. In these mind states, information received is more irrational, illogical and invariably without explanation until sufficient information is obtained and collated back in the realms of the conscious mind. Ideas are allowed to remain fluid until a structure can be identified to subsequently make the information objective when brought back into the realms of the real world.

The process begins with the problem situation unstructured (Stage 1) and the problem situation expressed (Stage 2). Checkland [5] defined a problem situation as *ideas and events* that exist in the *real world* that *at least one person views as being problematic*. The two initial stages are essentially related and both require a database of historical information which is usually obtained through secondary resources. Using rich pictures, the problem is identified and visually expressed. These two stages show how the problem came about in the real world. An analytical process is then used to define and describe the problem in a clear format. The actors are introduced and their relevance to the situation is defined. These two initial stages should depict a holistic overview of what is currently happening in the real world as perceived by the researcher (s) with the problem situation with intent to offer a proposal for improvement [11].

The problem situation unstructured (Stage 1)

Unstructured, is essentially the initial perception of the problem situation in the early stages of the investigation. In relation to the colour forecasting process for the fashion industry, the main points that came from the literature reviewed for the study were used to develop a series of rich pictures. We refer to some of these points in order to briefly explain the corresponding rich pictures putting the problem situation into context which assists the reader to understand the development of each picture. A number of rich pictures were created to represent this problem situation as it changed throughout the time period studied, this served to better understand and define the current forecasting process. The number of rich pictures required at this stage would depend largely on the problem situation under study, the researcher's abilities and determination to uncover or expose as many of the elements as possible and the extent of the previously researched background and otherwise supporting information available.

The rich pictures

The first rich picture (Figure 2) demonstrates the class distinction just prior to the onset of the industrial revolution with the wealthy in their stylised and colourful attire placed above the mass

population in their shapeless, drab coloured common clothing that clearly sets them apart from each other. Though simplistically drawn in an almost crude cartoon style that is typical of the rich picture tool, the illustration easily tells the story of the situation and the additional narratives help bring clarity and therefore richness to the picture. The presentation style is indicative of the two basic layers of activity occurring at that time and the linearity of the system.

Pre-industrial revolution

Colour once played a key role in class distinction, clearly shown in Figure 2. Style then became the main point of difference which is clearly illustrated in the second rich picture (Figure 3), which generalises the situation throughout the period of the industrial revolution.

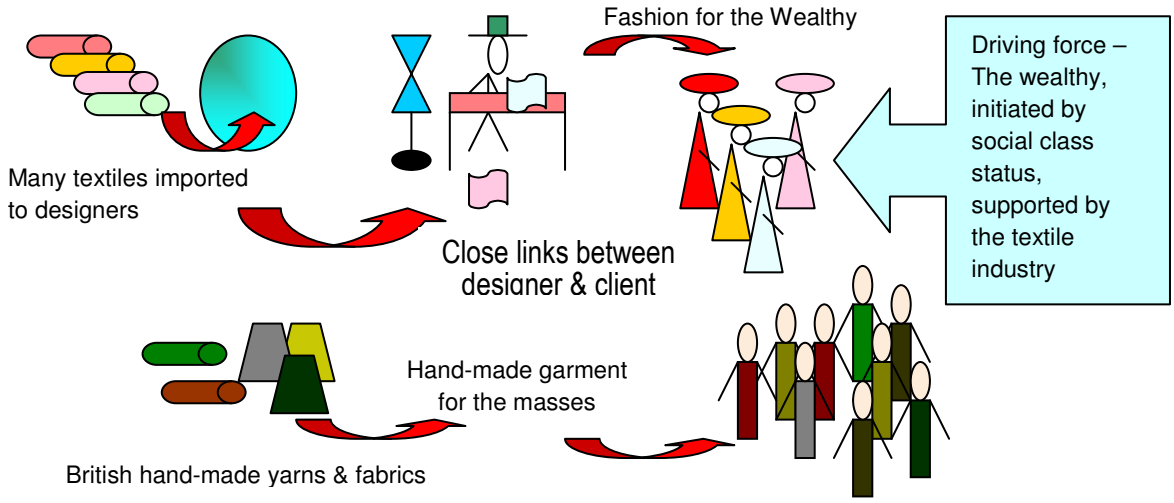

Figure 2: The driving forces of fashion pre-industrial revolution [20, p93].

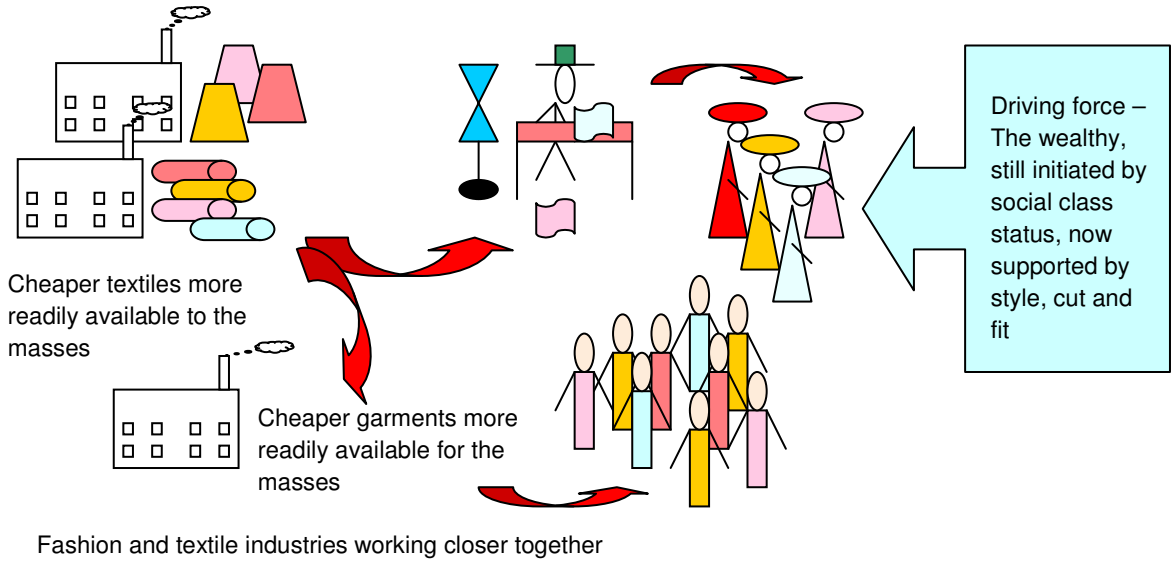

Figure 3: The driving forces of fashion during the industrial revolution to the end of the 19th century [20, p94].

The factories also depict the development of the British textile industry and with the omission of the globe (in Figure 2) that represented importing fabrics, we can sense a localisation of the industry (Figure 3). Again, the use of narratives helps to clarify and add richness to the situation, and the overlapping arrows demonstrate unity at the industrial level working together to serve, what can essentially be seen as two separate markets.

Industrial revolution to the end of the nineteenth century

The literature informs that British manufacturers began to source inspiration from America and the Parisian haute couture (high fashion) sector which also became an important source of inspiration for garment manufacturers. Figure 4 stresses an important turning point at this period of time where perhaps confidence in their own design ability or that of their work force was insufficient enough to seek inspirations from elsewhere and really pinpoints the beginning of a growing need in the industry for design direction. This rich picture therefore plays a very significant role in the understanding of the need for the colour and general fashion forecasting sectors in the industry at this point in time.

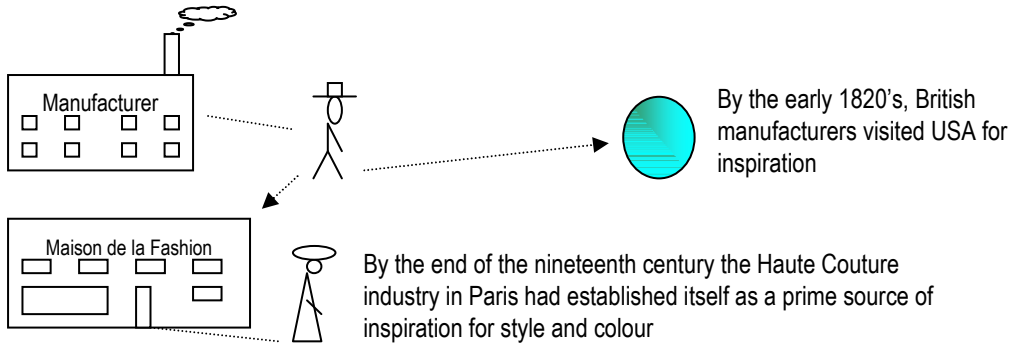

Figure 4: Early inspiration sources [20, p94].

The turn of the century

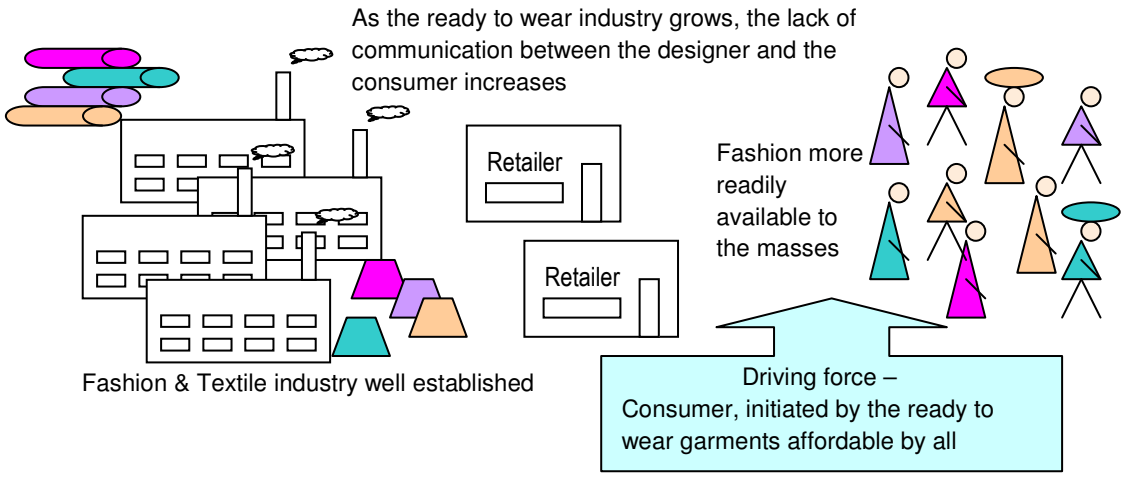

Figure 5: The driving forces of fashion in early 20th century [20, p95].

Research indicated that at a time when the British textile industry was well established and the fashion industry was gaining momentum, a distinct relaxation of social classes and dominant changes in lifestyle and social values were all evident. As a result, the fourth rich picture (Figure 5) demonstrates diversity in style and a more eclectic mix of people styling themselves in accordance with their own tastes and preferences, but doing so with a limited colour palette and limited style variations. The figure also introduces the retailer sitting in between the manufacturing sector and the mass population, which now assumes the title 'consumer' as marketing terminology also gained a foothold in consumer product industries in general at this time. Through the presentation, we can see a growth in the industry but sense competitiveness rather than supporting each other, as in Figure 3, and a clear lack of communication with one, albeit, eclectic market is evident.

The end of the twentieth century

Figure 6 is a rich picture of what the industry looks like today and can be generalised to almost any country that has a developed fashion industry. The number of manufacturers may differ in relation to the number of retailers but the main point to note is the inclusion of the colour forecaster, who by way of the process being studied, is by and large directing sets of colours through the industry in any one season of a year. The box used to surround the industry players is used to denote a degree of control, which helps to provide a consensus of colour that can then be recognised and marketed as a trend. The consumers are outside the box as consumer information, with particular reference to consumer colour acceptance or preference is not currently included in the process. The growth of marketing that became evident in the literature demonstrates that it is basically a support system for the fashion industry, while this was not under scrutiny in the study its importance to the system warrants its inclusion in the rich picture. Because marketing is viewed in this instance as a support system, it has been placed underneath the industry to show its place in the visual representation.

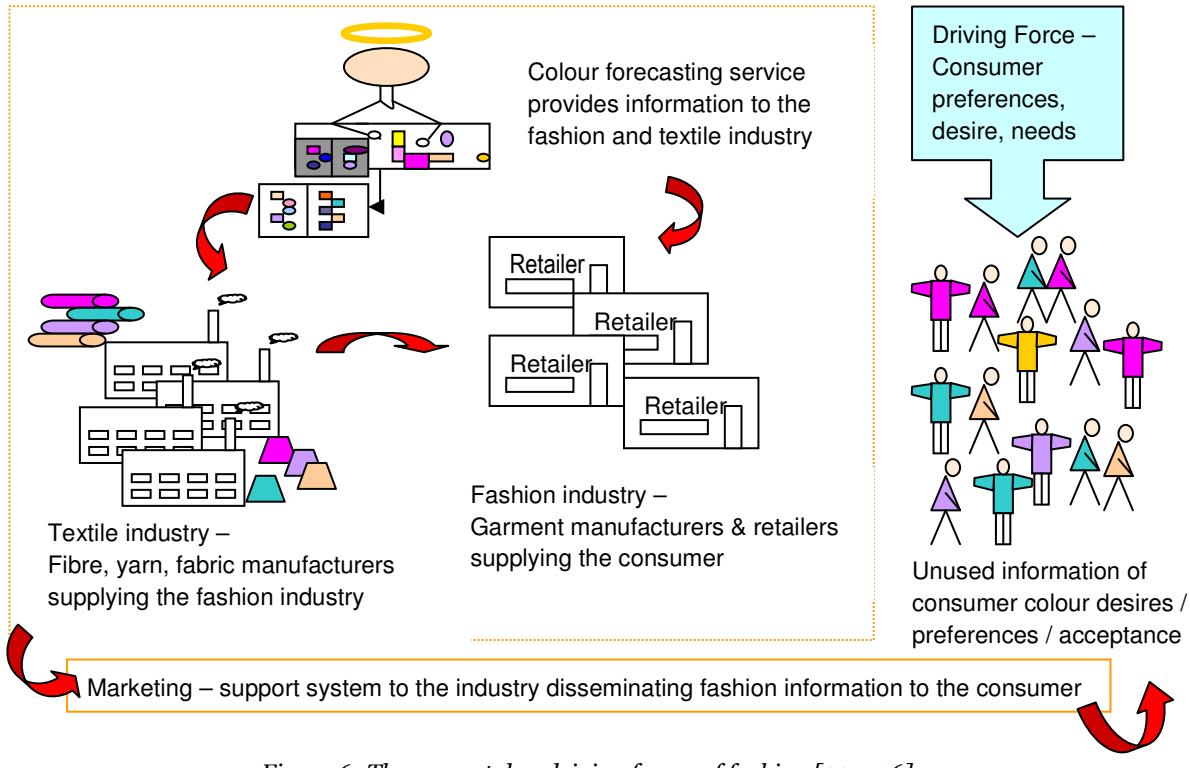

Figure 6: The present day driving forces of fashion [20, p96].

The actors of the system

It is also a requirement of the methodology at this stage to identify not only the problem situation, but also who essentially owns this problem and the actors involved in the process. Checkland [5], and later with Scholes [8], proposed that the analyst (researcher) can be identified as the problem owner, along with any other person(s) who will effectively benefit from any improvements made to the process as a result. Patching proposed that the employer of the analyst is the real problem owner and the analyst is the problem solver [11]. Checkland defined the problem solver as the person(s) who '*bring about improvements in the problem situation',* suggesting that this may not necessarily be the researcher [5].

In this instance the problem owner could be identified in any sector of the industry that is involved in the colour forecasting process. A further rich picture was developed to demonstrate this, shown in Figure 7. It can be seen that the actors who work with the colour forecasting process are shown in each of the industry sectors. To keep the picture simple only one actor and one factory for each manufacturing sector and retailer are used as a representation of the large number of companies and actors which exist in the real world. The hierarchal actor in the colour forecasting sector is depicted wearing a halo this is symbolic of their power and influence over the industry. Again in the real world more than one person works in this sector to initiate seasonal colour directions to the industry. The other actors in the rich picture use the trend information purchased from the forecasting sector to inform their own colour forecasting process and ultimately their company's product range.

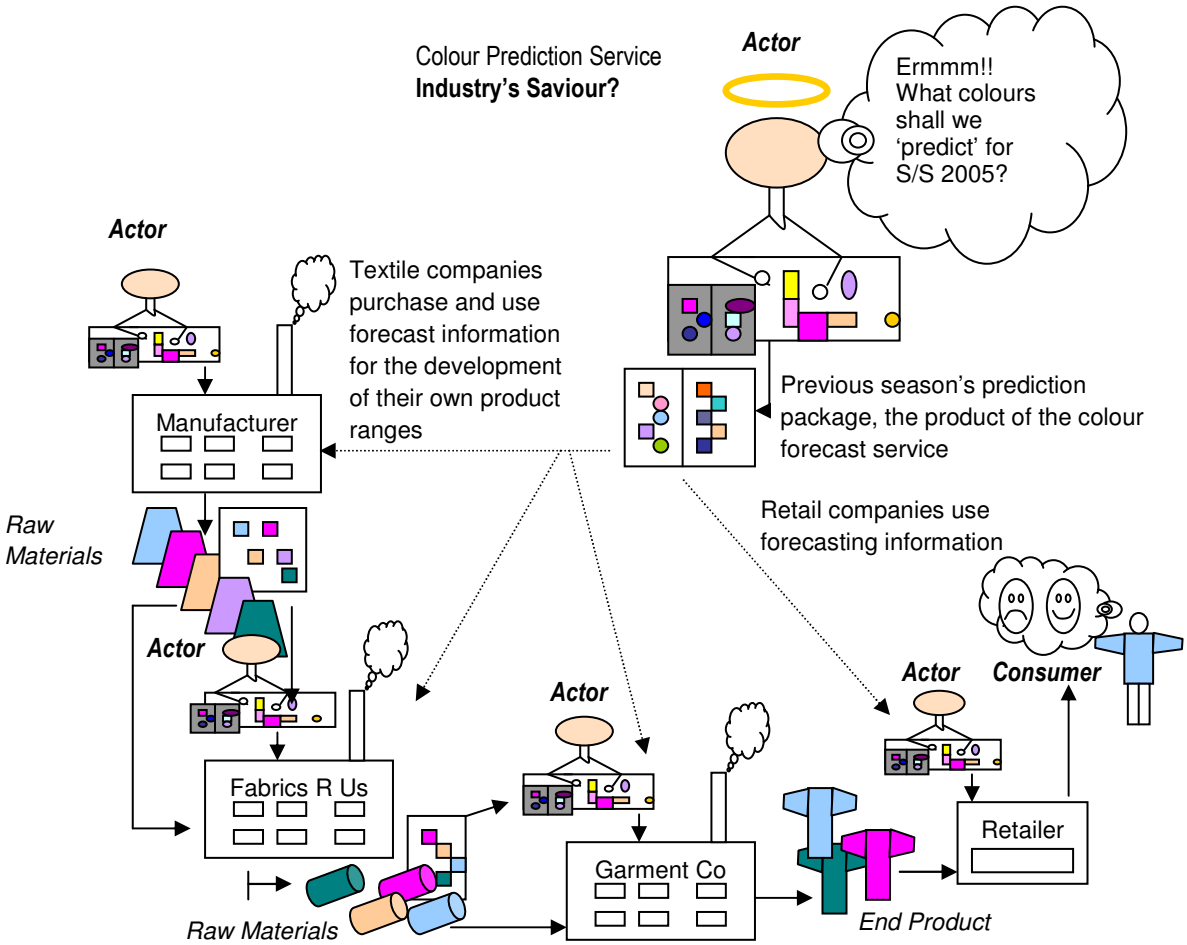

Figure 7: Identifying the actors of the colour forecasting process [20, p85].

The problem situation expressed (Stage 2)

In order to develop this stage a large database of information surrounding the problem is necessary that again is usually derived from secondary sources, but can be complimented with primary research, such as interviews, focus groups etc. Figure 8 shows a rich picture of the problem situation expressed. Here, a range of opinions of the colour forecasting process were collated from people in the fashion industry derived from secondary resources and interpreted visually. It can be clearly seen in the rich picture that two extreme viewpoints exist, those with positive connotations and those of a more negative nature.

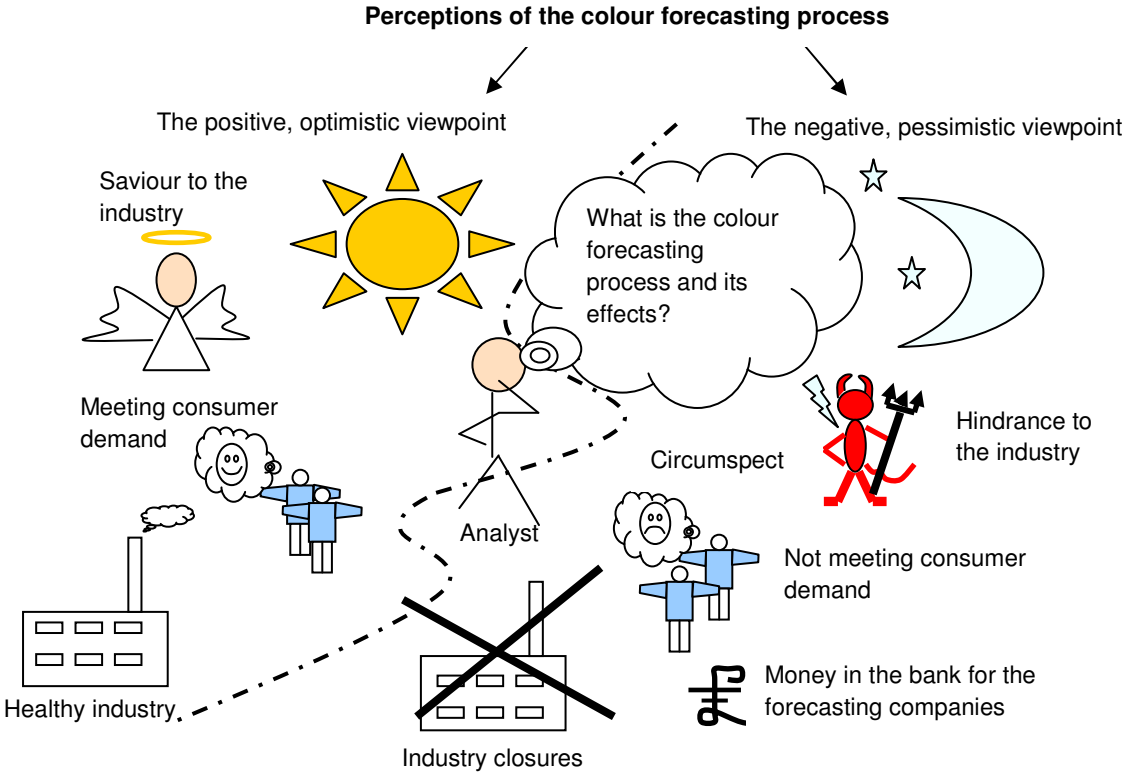

Figure 8: The positive and negative perceptions of the colour forecasting process.

In reality a combination of the two perspectives is likely. However, the rich pictures tool at this stage of the methodology promoted the concept, that perhaps if the softer or more subjective elements of the process were better understood to give the process more credibility and, or, the forecasting process as a whole demonstrated a higher success rate, then it would be a more effective tool for the industry. The problem therefore could be expressed as: *the colour forecasting process is a tool that provisionally has potential to assist the fashion and textile industries to thrive but is currently little understood and as yet under-developed and consequently under-estimated*. The rich pictures tool was therefore instrumental in the initial stages of the methodology to understand the underlying problem and to give this problem situation a concise definition.

Further analysis

Colour forecasting as a system could be defined as being an open system, where there is a beginning and an end, in other words it is a linear process. At the beginning there is the intention to produce

seasonal trend packages to be sold throughout the industry, informing subsequent colour forecasting processes for the purpose of product development and the consumer is at the end of the system wearing the fashion products. In Figures 2, 3, 5, 6 and 7, the rich pictures show the consumer as a constant primary driving force of fashion. It is important to note that the consumer ultimately determines the effectiveness of the seasonal colour trends and therefore the validation of the trend predictions through their purchasing choices of the resulting fashion products.

Currently, consumers are only considered to be part of the process in relation to previous sales data. However such data is only a representation of the acceptance of colours offered at one small period of time and not a reflection of their overall preferences. Also this data does not account for lost sales due to unacceptance levels of the colours offered at any point in time. This was evident through the survey undertaken. If the system was closed so that consumer colour acceptance or preference data informed and became a part of the inspirations for seasonal colours, then maybe more favourable colour ranges would grace our high streets, which is essentially the hypothesis that had evolved from the research undertaken by this stage in SSM. From this, an ideal model was proposed to the survey participants in the latter stages of the research discussed later in the Section on real world / systems world comparison (Stage 5). Thus the visual representations and the knowledge gleaned from the research information sourced can assist the researcher to not only see the problem situation as it is but also to visualise, interpret and record alternative scenarios in relation to the problem situation. The rich picture below in figure 9 shows the closing of the system bringing the consumer, who was identified in the study as being the missing link, into the colour forecasting process.

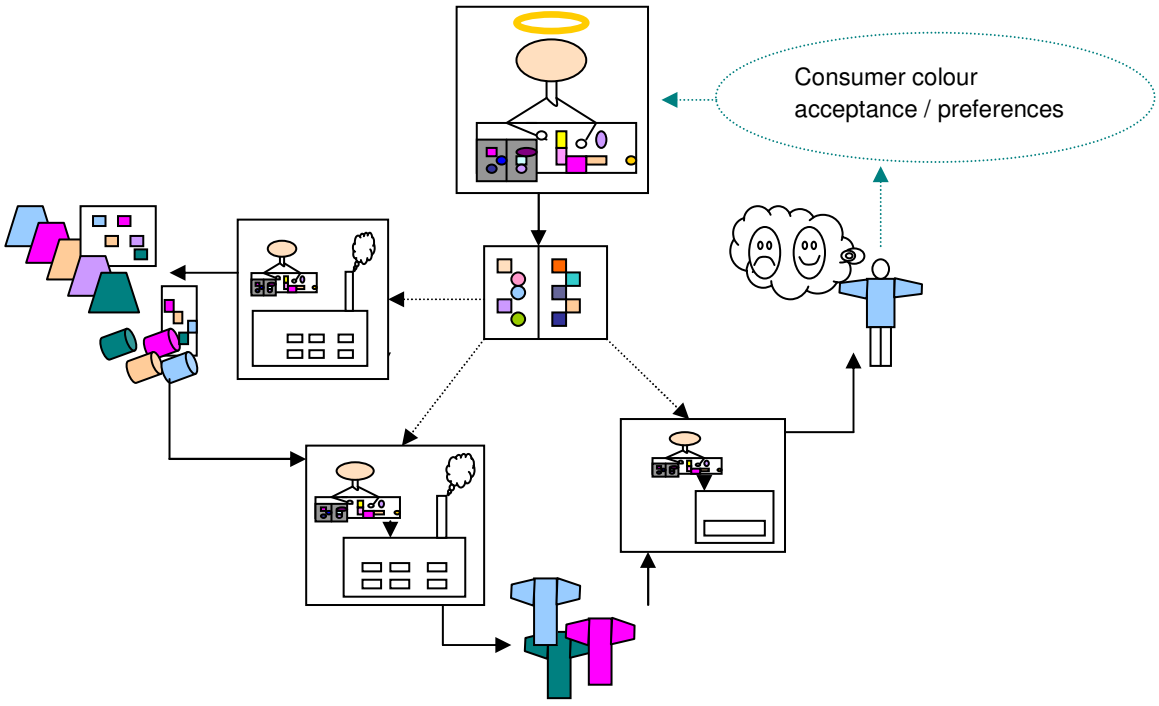

Figure 9: The missing link – consumer colour acceptance / preference information [20, p97].

However, in hindsight, the major drawback with this alternative scenario concept is the knowledge that the colour forecasters in the specialist sector produce generic colour directions in order to sell to a large number of companies. Whereas, fashion and related industries favour the use of more specific target markets or segments in their marketing strategies. Therefore a system that allows consumer

colour data to be incorporated into the inspiration mix would be, at least in theory, highly desirable to the information users but of little or no interest to the forecasting agencies that service a large and diverse market. We return to this point later when we discuss the owners of the system as we work through the stages of the methodology.

The importance of rich pictures for the creative researcher

The revelation outlined above in relation to the alternative scenario may not have been so easily apparent without the information being presented visually using the rich pictures tool. This point serves to emphasise the importance of rich pictures in the methodology, but we would propose the tool to be highly valuable in its own right. Certainly in the early days of developing SSM, Checkland appeared to have under-estimated the importance and potential of rich pictures, as its only reference in *Systems thinking, systems practice* was given in the glossary as being '*the expression of a problem situation compiled by the investigator, often examining elements of structure, elements of process, and the situation climate*' [5]. Little wonder creative people would not understand the potential of SSM for design research at this time. Thankfully Checkland either saw the error of his ways, or Jim Scholes' input to the publication *Soft systems methodology in action* went some way to at least demonstrate the use of this tool more fully, though disappointingly with very limited use of images other than sparsely used pictograms and lots of words or statements [8]. The resulting rich pictures therefore more resemble mind maps. Checkland, in his earlier work [5] and later with Scholes [8] dedicate more space to the discussion of the CATWOE test as a tool used in Stage 3 of the methodology to arrive at a suitable root definition of the system, introduced in the following section, than they do to rich pictures. We feel that our contribution to promoting the use of SSM in design research may largely stem from our conviction for the greater potential of more imaginatively developed rich pictures as part of a creative research process, that is not only more engaging but also brings a richer understanding to the problem being studied.

Root definition (Stage 3)

The root definition is the researcher's statement derived from the initial research of the activities and aims of the system. At this stage SSM leaves the real world scenario and goes into the realms of the systems world, where the researcher defines the most appropriate viewpoint of the situation that essentially reflects the aims that the system wishes to achieve. The CATWOE test is used to assist the researcher in the process of constructing a the root definition which may be written, re-written, defined and redefined any number of times before a satisfactory statement expressing the problem situation is clearly achieved. The root definition indicates the minimum number of activities that exist in the system and identifies the task in hand. At this stage this is the opinion of the researcher until such times that the concept is discussed with the actors, who are directly involved in the situation. After which relevant alterations can be made to any one of the stages.

The following two root definition variations are examples of iterations applied to colour forecasting prior to testing. As shown previously in Figure 8, there are two basic viewpoints of the colour forecasting process under consideration; the positive and the negative. These were initially expressed at this stage as follows:

> *Colour forecasting is provided by a specialist service that makes available on a seasonal basis, information through a process of evaluation and analysis to*

accurately anticipate consumer colour preferences / demands for predetermined seasons in the near future for a fee. Presenting and delivering the information with a strong consensus to the fashion and textile industry to use as a tool to assist them in their own choices of colour ranges for their products that will be profitable for their company.

Colour forecasting is a process to accurately anticipate consumer colour preferences / demands for predetermined seasons in the near future. In order for the fashion and textile industry to use as a tool to assist them in their own choices / selection of seasonal colour ranges for their product that will be profitable for their company.

These holistic viewpoints attempt to define colour forecasting. It is important for the root definition to be well defined and it must be tested. Testing may be a consistent critical assessment by the researcher to clear any ambiguities, constructive assumptions and clarified descriptions. Checkland endorses the use of CATWOE, a mnemonic for: **C**ustomers, **A**ctors, **T**ransformation, **W**eltanschauung or **W**orld view, **O**wners and **E**nvironment to test the root definitions. Essentially one word answers or very short statements identify each of the CATWOE elements [11]. Checkland and Scholes state that the transformation process and weltanschauung are at the heart of CATWOE and the remaining elements serve to assume that at least one person *undertakes the activity; could stop it; will be a beneficiary or victim of it; and will operate within certain environmental constraints* [8]. They also recognise that some Government analysts have replaced weltanschauung with '*viewpoint*' and therefore used the mnemonic VOCATE instead. Checkland and Scholes obviously found disfavour with this alternative describing it as '*vapid*'. This would suggest to us that the way that business minded SSM authors tediously discuss the methodology may be a barrier to researchers in the design community. For this reason we continue to make reference to rich pictures throughout our CATWOE test to show that the methodology can be used in a creative manner throughout.

The CATWOE test

Customers or clients

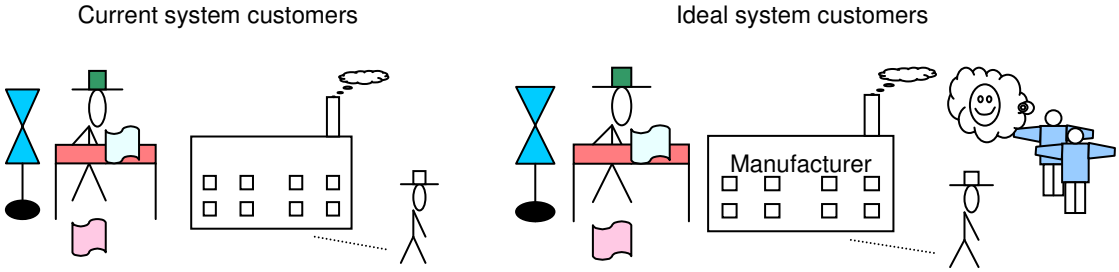

Figure 10: The customers of the current system (left) and the customers of the ideal system (right).

The customers or clients include those who use the system or receive some kind of benefit from it. Figure 10 shows the current customers of the colour forecasting process as those whose role incorporates colour range development and selection for their company's products, i.e. designers and buyers; and the alternative scenario discussed earlier where ideally consumers are also beneficiaries of the system through the availability of desirably coloured products on the high street. The level of

benefit here is the real crux of the matter under consideration and determines the effectiveness of the process as a whole. Beneficiaries could also be viewed in the negative; the victims of the system.

Actors

The actors were identified earlier and shown previously in Figure 7. The actors carry out the activities of the system, or are instrumental in providing the benefit to the customers. The colour forecasting agencies can be viewed as being the primary actors and the secondary actors being the employees of the fashion and textile industries that undertake the role of colour forecaster within their company. In the current system the consumer is not an actor.

Transformation

Transformation and Weltanschauung / World view were considered by Patching to be the two most important elements of the CATWOE test, and recommended that the analyst may prefer to begin with these as they form the basis of the conceptual models developed in Stage 4 of the methodology [11]. Transformation is the change that takes place within or because of (due to) the system, that is; the conversion of the input to the output and is expressed as a statement. It was recommended by Patching to first identify the output and then the input. The output of the colour forecasting service provided by the agencies in the specialist sector is the colour story for a specified season. Its presentation format i.e. the prediction package could also be considered an output of the company. It is indeed possible to have different levels of input and outputs. The input comprises the essential components of the system that are instrumental in the development and production of the output. The actual developmental stages are the transformation, that is, the conversion of the information derived from the different sources identified as input into the final colour story or prediction package, identified as the output. The transformation of the colour forecasting process is expressed below as a statement and further shown in Figure 11.

Transformation statement is a process of continually sourcing additional data either through a controlled or random manner in conjunction with thought, decision and reasoning processes that bring about the final colour story. This claims to anticipate colour preferences of the consumer for a given season in the near future.

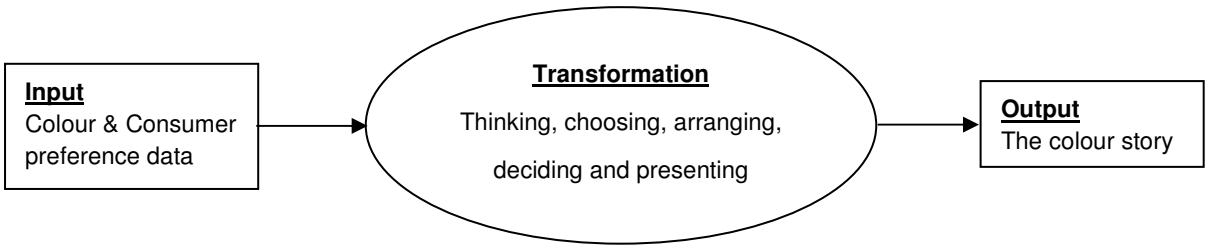

Figure 11: Transformation of the colour forecasting process.

World view

The weltanschauung or world view looks at the perception of the system from a particular viewpoint. Patching recommended using the various actors to establish their possible viewpoints based upon research. At this stage this is still the researcher's assumptions. Patching also pointed out that in reality, it depends upon a '*person's background, experience and particular interest in the*

situation' [11]. This is further developed when key actors are approached for their opinions and perceptions, this would be their personal viewpoint and not necessarily a shared or general one.

The secondary research sources were used to determine the world view which included the development of the rich picture shown in Figure 8. Discussions with a significant sample of consumers also revealed that there is little or no knowledge of the system's existence. Those realising that such a system must logically exist have no apparent knowledge of how it works. The worldview of the system could therefore be ignorance and misunderstanding.

Owners

The actors were defined by Checkland as '*a person who carries out one or more of the activities in the system*' that we previously defined as being any person who is involved in using the colour forecasting process [5, p312]. Checkland defines the owners as '*the person or persons who could modify or demolish the system*' [5, p318]. Patching's interpretation of ownership simply suggests that the owners of the system are those that cause it to exist or those that could cause it to cease existence [11]. In this instance, the actors who use the colour forecasting process can also be defined as owners. However, it is debatable whether the colour forecasters in the specialist sector can truly be expressed as owners, as the activity of the colour forecasting process would continue within the fashion and textile industry, just as it did so prior to the establishment of this sector. However, without those in the fashion industry that use the process there would be no reason for the system to exist.

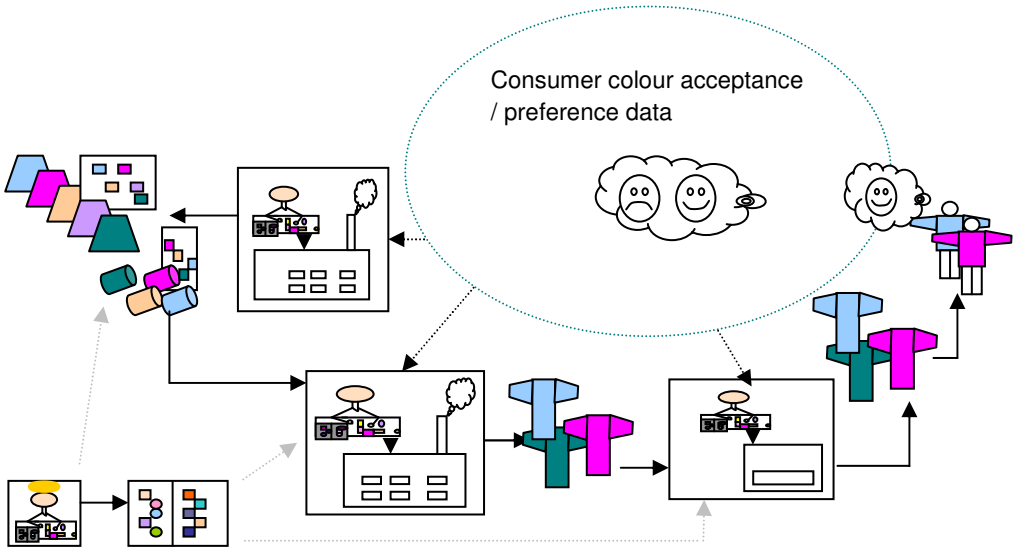

Figure 12: A modified model of the missing link lessening the importance of forecast data and bringing the consumer to the heart of the process.

The research at this stage enables us to draw the conclusions that the colour forecasters working in the agencies in the specialist sector are purely actors and those using the process in the fashion and textile industries are both actors and owners of the system. Hence, the monopoly essentially created by the forecasting sector does not exist in reality, rather the fashion industries have been lead to believe in the importance of the relatively newly formed sector. This then brings us back to a point made earlier regarding consumer colour data being a better input into the process at industry level rather than at the level of the forecasting sector. We can therefore go back and modify Figure 9 as shown in Figure 12, with consumer colour data at the heart of the process and the colour forecasting

sector providing a less valuable source of inspirational input. We can therefore clearly see how SSM is an iterative process allowing us to go back to any stage, at any time, in order to develop the research.

Environment

The environment is referred to as the world that surrounds and influences the system, but has no control over it. Checkland states that the environment *lies outside the system boundary* and the constraints are the assumed impositions [5 p314]. In the current system the consumer could be viewed as being part of the environment that includes all the implications of societal, cultural, economical and political issues, the availability of raw materials and competitors. These are all tangible constraints and elements that the colour forecasting sector claim to take into account when developing their seasonal colour stories, thus attempting to bring these into the process yet still ignoring the value of consumer colour data as part of the process. There is also a more subjective element that helps to shape the environment in our study; that of fear experienced by the industry of making costly mistakes. This intangible element has enabled the forecasting sector to establish a monopolistic existence in the fashion industries and consequently has a strong grip on industry personnel. Our improved model was developed to hypothetically reduce the power of the specialist sector by improving the colour forecasting process for the industry to confidently and competently develop their own colour ranges that are desirable for their own target markets.

Refining the root definition

The CATWOE test helps the researcher to further conceptualise the system from different avenues and to further develop the research through iterations to then redefine the root definition by testing the original variations so that an adequate encapsulation of the system is achieved. The CATWOE test resulted in the modified root definition given below which then formed the basis of the conceptual models produced in Stage 4 of the methodology.

> *The collection, analysis and interpretation of colour and consumer preference data to produce a package / tool which can be used by the fashion and textile industry in the decision of colour choices for future product ranges.*

Conceptual models (Stage 4)

Patching realised that Stages 3 and 4 of SSM can overlap. Some may prefer to complete Stage 3 prior to attempting Stage 4, while others may prefer to begin to develop the initial conceptual models while working through Stage 3 as the transformation element is the basis of the conceptual modelling stage [11]. A conceptual model simply illustrates the relationship between the system activities graphically. The model(s) are based upon the root definition and usually expressed with verbs, but always using the minimum necessary activities for the system. It shows all the necessary components of the transformation of input to output as described in the root definition. Sub systems can be identified from the model. Each sub system can then become a system in its own right; this process is known as decomposing. Sub systems can then be developed individually, as it is recommended to keep the model simple by using only five to ten activities for each model. The activities are then to be expressed in terms of what is being done as opposed to how it is done. How an activity is achieved can be used within the root definition as a constraint of the system, such as how a particular activity will be controlled.

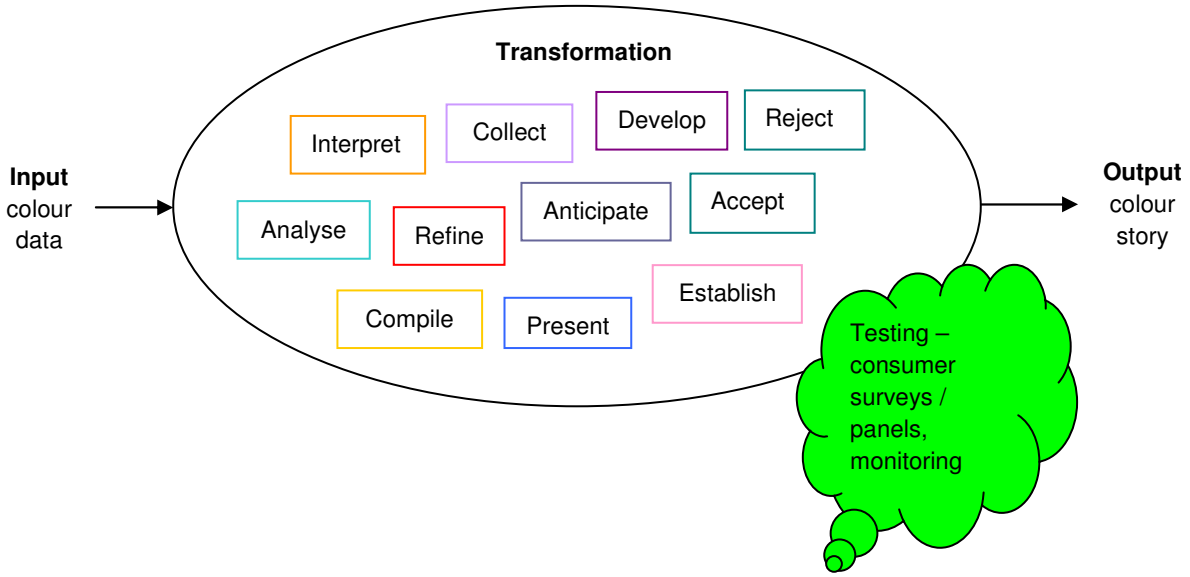

Figure 13: The basic transformation model incorporating the most relevant verbs of the colour forecasting process.

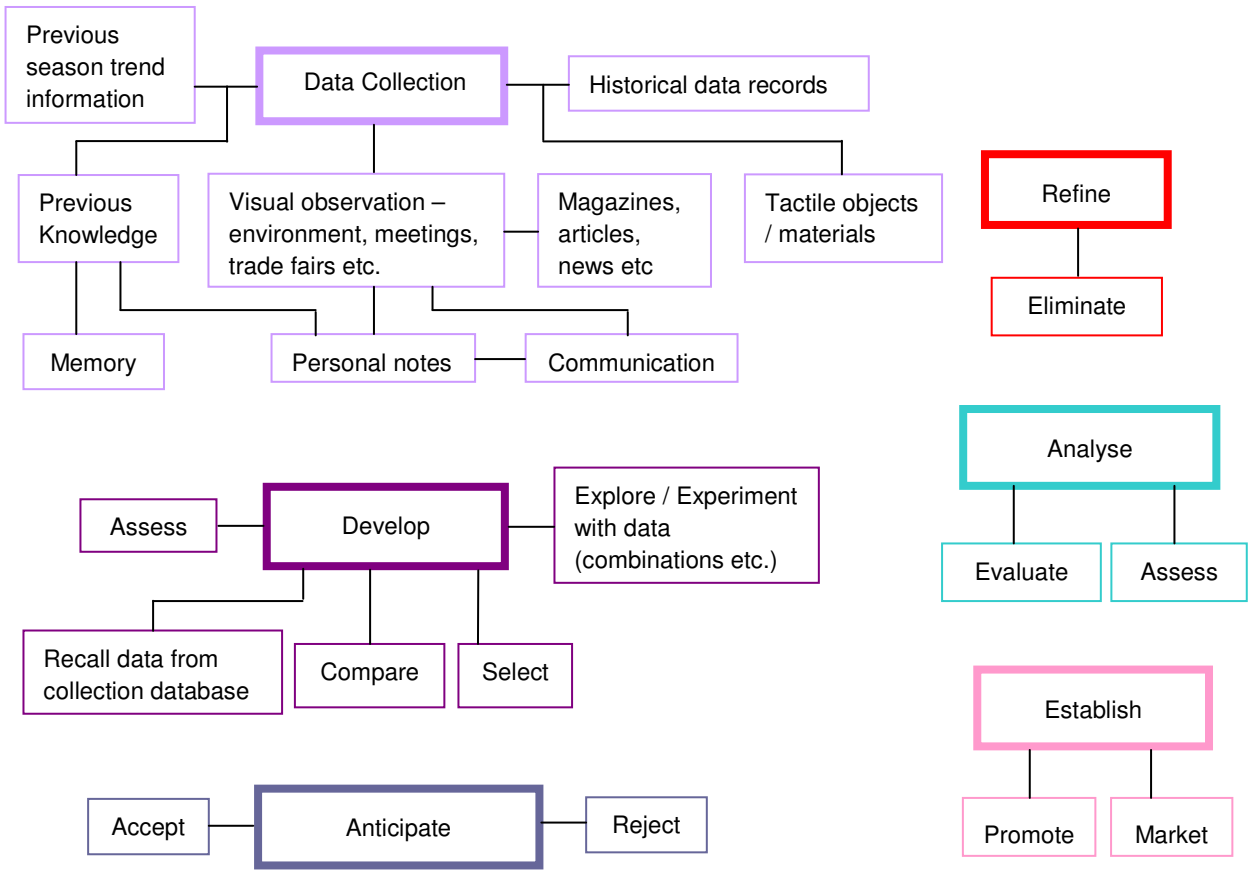

Figure 14: Sub-systems using the verbs from the transformation stage.

Patching defined the aim of SSM as a learning curve, a tool to assist the analyst to better understand the problem area by clarifying it and assessing ideas that may or may not improve the system [11]. It was not designed to be a solution to a problem specifically. The model is not to be considered right or wrong, simply a representation of how the system exists or could be in reality. Models can be presented in a number of ways preferable to the researcher. Two popular modes are flow charts and mind map structures. Flow charts show activities in a logical sequence where mind maps are less structured. The transformation of the colour forecasting process was shown previously in Figure 11. We now show in Figure 13 the verbs that were identified from the literature review conducted for the study incorporated into this basic transformation model and in Figure 14 we show these verbs as sub systems.

From the initial models shown in Figures 13 and 14, two further models were developed. The first, shown in Figure 15, is a representation of an ideal model for the colour forecasting process, incorporating the collection, analysis and testing stages of consumer colour preference data. The second model, shown in Figure 16, represents the current process.

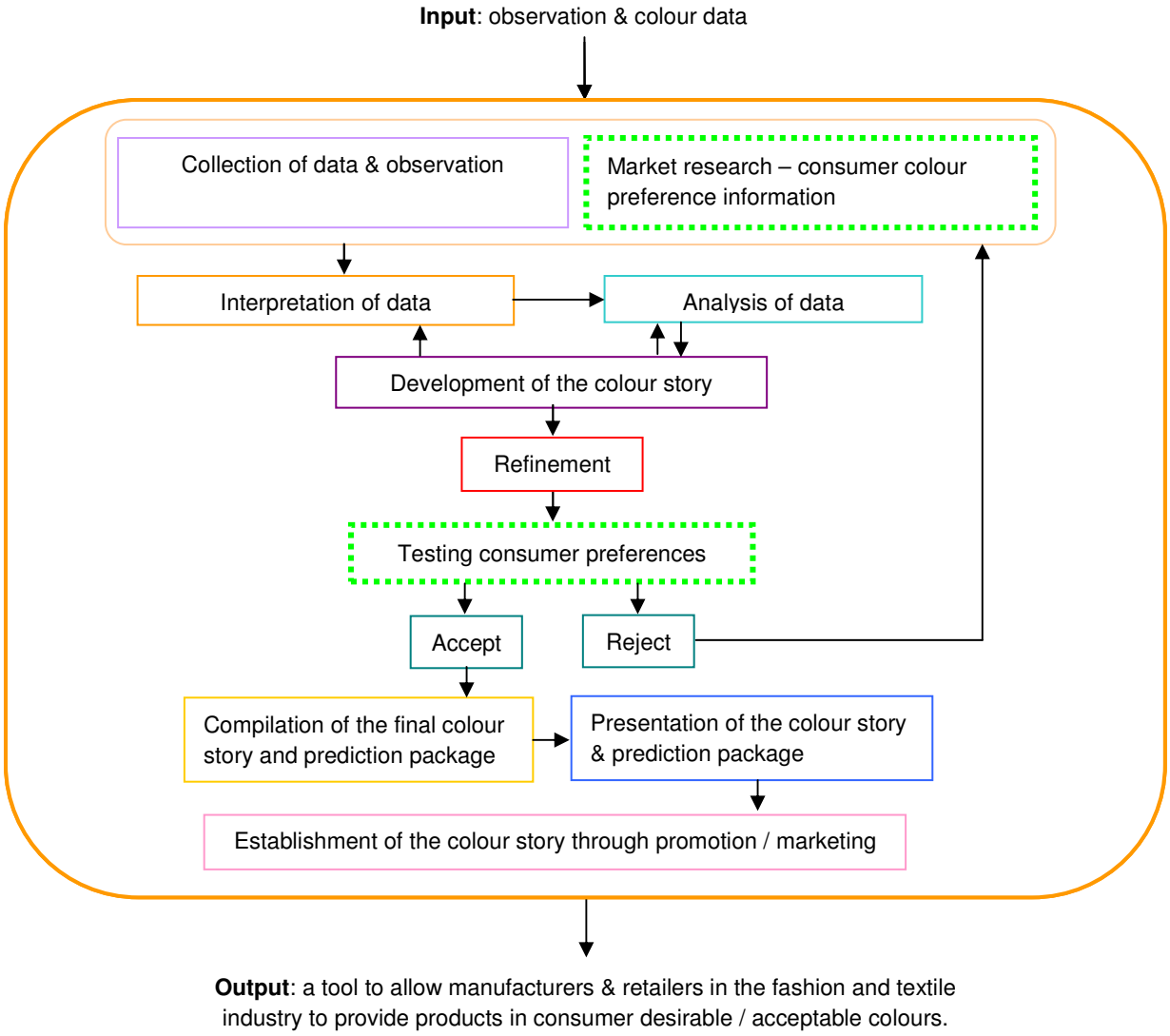

Figure 15: The first model of the conceptualised ideal colour forecasting process.

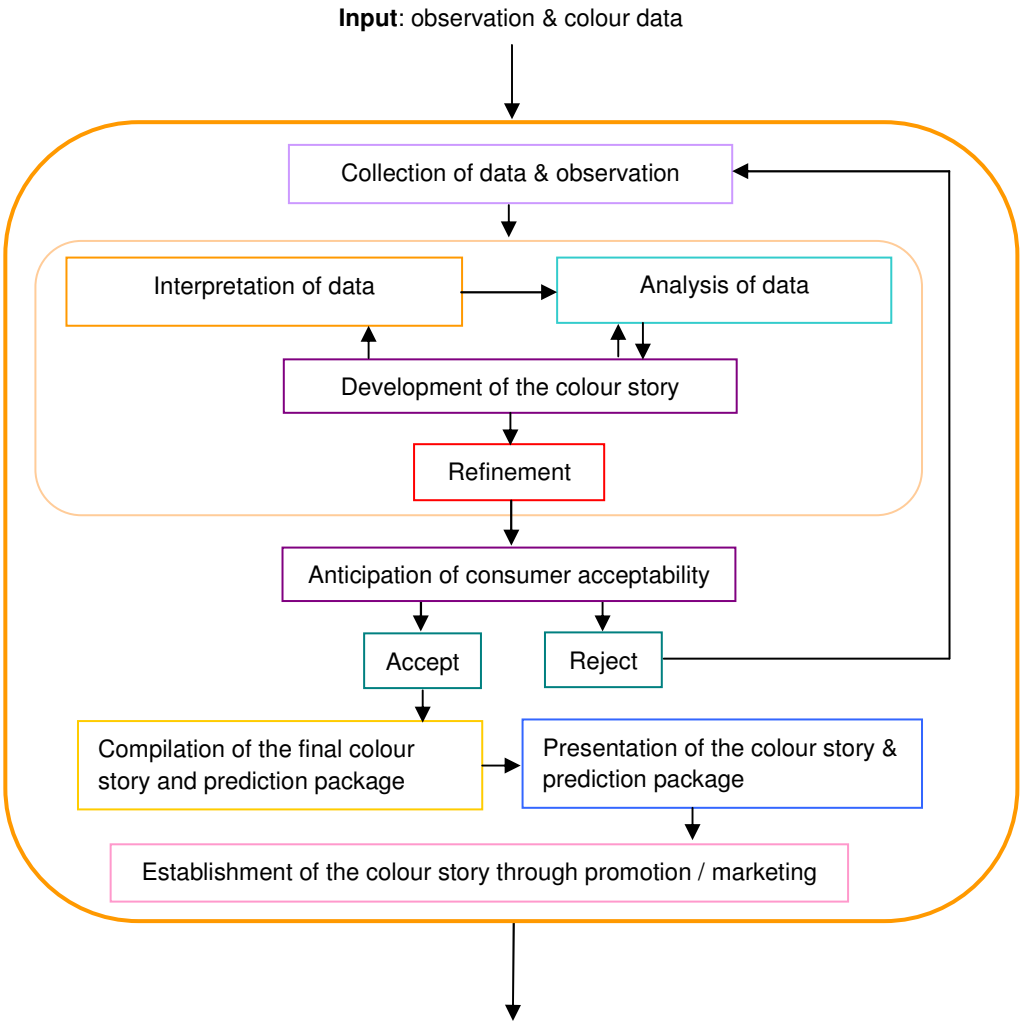

Figure 16: The first model of the current colour forecasting process.

Real / systems world comparison (Stage 5)

In accordance with SSM Stage 5, the two models (Figures 15 and 16) needed to be tested and validated. This was achieved by sending them along with a short questionnaire to those we previously identified as being the actors and owners of the system who use the current colour forecasting process in the fashion industries. 300 sets of models, questionnaires and covering letters were sent to personnel in the fashion and textile industries using a random sampling selection process to in order to capture a representative sample of the industry across all sectors who engaged with some kind of forecasting process that suits the needs of their particular company. The respondents included 132 designers working in the manufacturing sector with a 24.2% response rate, 133 buyers working in the retail sector with a 46.6% response rate and 35 forecasters working for forecasting agencies with a 31.4% response rate. The overall 37% response rate could be considered average from a postal survey however the problem of secrecy surrounding the colour forecasting process may have contributed as an unfortunate consequence of researching a controversial and monopolistic area.

In the survey, the model shown in Figure 16 was referred to as Diagram A. Respondents were asked 'Does the model accurately represent the colour forecasting process that you current use?' and if not to explain any differences. The proposed improved model, Figure 15, was referred to as Diagram B. Respondents were asked 'Do you agree that the improved model would be a better process than their current process to benefit their company?' if not, why, and respondents were offered the opportunity to give comments on the model. The results of the survey were then used to refine the models. The comments were collated into two categories, those supportive of the models and those with negative comments. Similar comments were grouped together. The general feedback included comments such as 'I think this would be of benefit to my company', etc., with no real indications of why. More constructive comments came from individuals who had particular issues with either of the models, such as '*Testing consumer preferences would be too time consuming*'. Mostly respondents liked the idea of the improved model but suggested that it would be more beneficial for the market research and testing stages to be conducted by a third party.

Validating the models

Through the survey, Diagram A (Figure 16), was verified as being a very close representation of the current colour forecasting process. In order to identify any omissions to the model, or any other discrepancies between the model and the respondents own methodology, respondents were given the opportunity to pass comment on the Diagram. The feedback offered constructive advice for slight amendments to the model which are discussed later in Stage 6 of the methodology.

Diagram B (Figure 15) was validated in principle as a potential improvement to the current colour forecasting process and more than two thirds of those surveyed agreed that the current system could or should be improved to benefit both the fashion and textile industries and the consumer. The results suggested that those involved in the colour forecasting process would welcome a database of hard information that would assist them to develop their colour stories with stronger objective tools. Again the respondents were given the opportunity to pass comment about Diagram B for suggestions of improvement, though most of the comments were unrelated to the models themselves and more to the problems that the users of the new model may encounter. There was a substantial amount of positive feedback to support the concept of the improved model. The general feedback was then used to shape the further research discussed later in Stage 7 of the methodology and specific feedback on the models was used in the following refinement stage.

Revising the two models (Stage 6)

At this stage, the information obtained from the people surveyed in the real world scenario was collated and examined in order to make adequate changes to the models. Three respondents questioned whether the analysis of the data should precede the process of interpretation of the information on both modules, a valid point that was considered to be incorrect at the developmental stages of the models. However, it was decided to leave the error to assess the acknowledgement of accuracy observed by the information users. Also, the output on Diagram A in short read: as a tool to provide consumer acceptable / desirable colours, where on Diagram B it read: consumer desirable / acceptable colours. This was to propose that the output of the current system is primarily concerned with acceptability and the improved system is concerned with consumer desirability. This was not commented upon by any of the respondents.

The revised models

Figures 17 and 18 show the revised models developed from the feedback presented by the respondents of the survey.

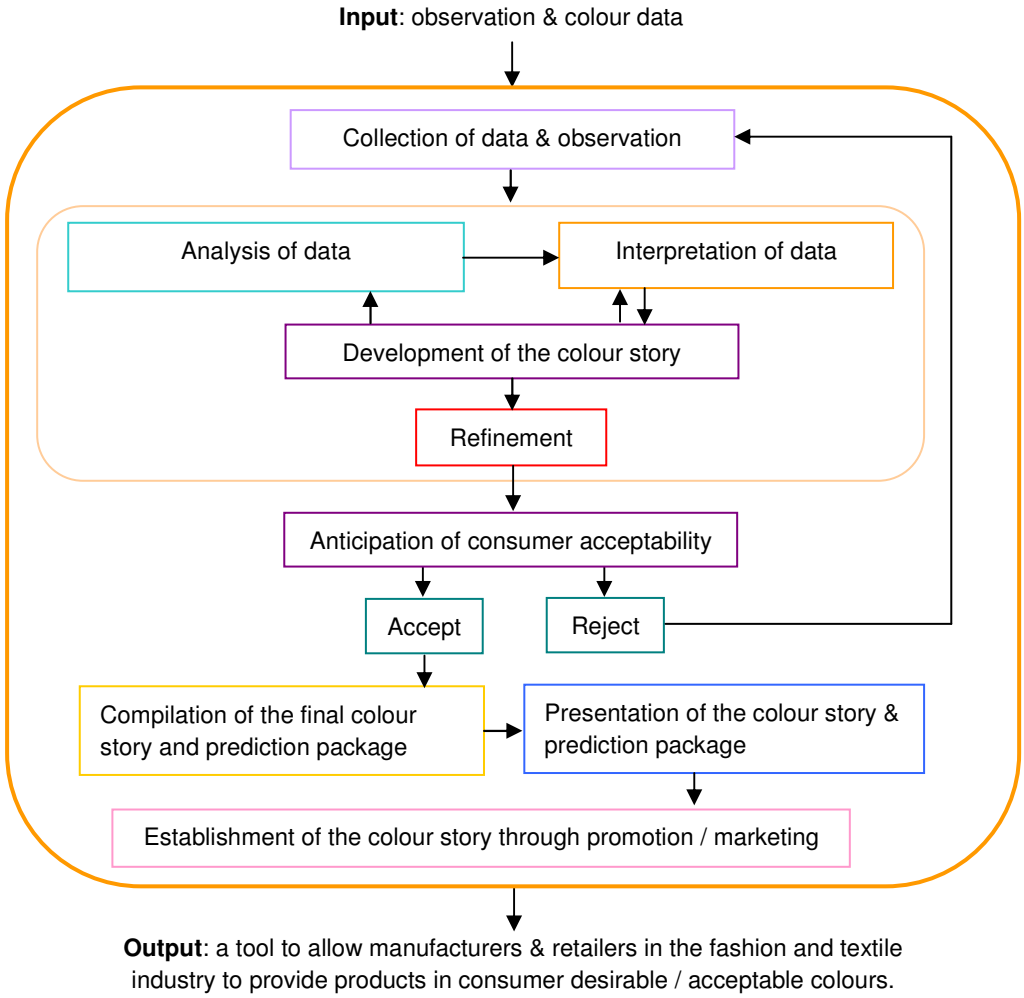

Figure 17: The revised current model of the colour forecasting process.

On the revised current model, shown in Figure 17, the order of interpretation and analysis processes were changed around as previously stated. Alterations were made to the proposed ideal process model shown in Figure 18. First of all, the analysis and interpretation processes were reversed as per the current model. It was considered appropriate to exclude the 'accept and reject' stages in favour of a stage of 'selection & elimination' which would logically appear between the analysis and interpretation stages. This eliminates the need for the acceptance and rejection, and also the testing stage. The collection of data and observation was changed to initial and continual collection of data and observation. The market research of consumer colour preference information was changed to market research – continual collection of consumer colour preference information.

The revised models could be retested and refined numerous times until the analyst is satisfied that they have reached a stage were the feedback is no longer contributing to a refinement process and that the models have reached the stage where they were considered to be adequately revised.

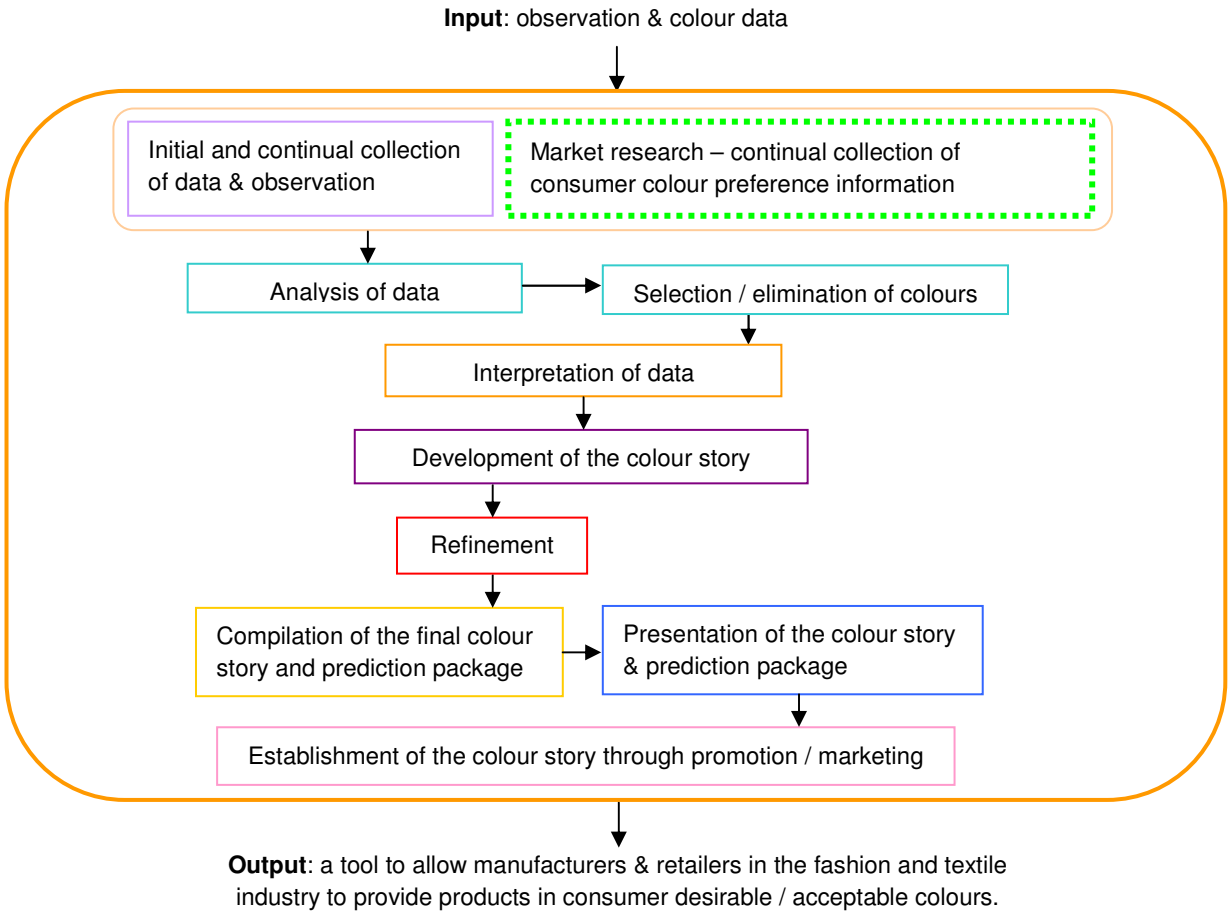

Figure 18: The revised proposed ideal model for colour forecasting.

Action to improve (Stage 7)

Stage 7 of SSM; action to improve, would only be realised if individuals in the industry adopted the suggested improved model. Also, Checkland and subsequent writers on SSM make the point strongly that different investigations can use whichever stages of the methodology which are considered suitable and that it is not necessary to use the model in its entirety [48]. However, in this instance research continues using the general feedback from the survey. The main criticism of the improved model was that the process of conducting market research into consumer colour preferences would be too time consuming to fit into retailers' current critical path. It was realised from those surveyed that users of the ideal system would benefit from having consumer colour preference data made readily available to them to use as input into the process as a labour saving and cost effective alternative. Therefore the research has moved towards developing such a tool for the industry that informs the user of favourable colours in relation to their target markets for their fashion product. A rich picture has been used to show a newly developed process model and continuation of the research in Figure 19.

The challenge in developing the model shown above in Figure 19 is collating the consumer colour data in relation to specific target markets. In the first instance personal colour analysis models were explored as a quick fix solution but these were found to have been formed on less than rigorous scientific colour foundations [21-23]. It was evident from the initial research at this stage that a method needs to be used that allows the model to be developed from scratch rather than trying to modify existing inappropriate systems. The research continues using contemporary colour mixing

theories to develop colour palettes that will then be subject to consumer testing [24] and inevitably SSM and its tools will continue to play a part in the development of this colour selection tool to better inform the colour forecasting process.

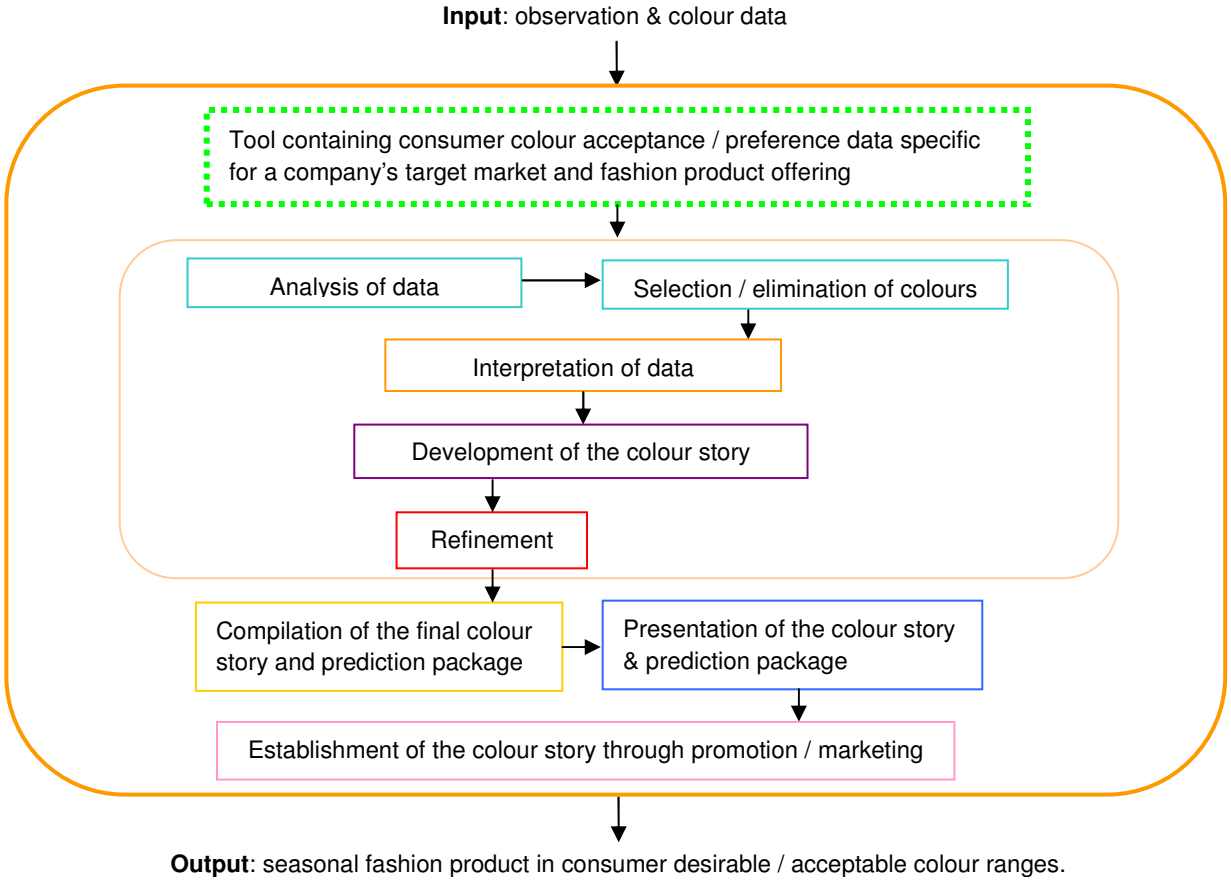

Figure 19: The new colour forecasting process model incorporating the tool to be developed through on-going research.

Conclusions

In this paper we have introduced soft systems methodology as a suitable design research method where a problem can be identified and conceptualised as a system. SSM was applied to the current colour forecasting process that is an integral part of design, consumer product development and buying for fashion companies and for many companies of its related industries. Throughout the paper we have described the seven stages of the method in a clear designer-friendly manner and made much use of the rich pictures tool in order to encourage creative researchers to develop an interest in the methodology and to understand its potential in design research. Hopefully, we have explained the symbolism of each rich picture in relation to the background research sufficiently and indicated the underlying emotive or sensory relationships as well as the immediate visual stories of each rich picture.

We have described how the first two stages of SSM helps to unpack all of the issues related to the problem under exploration visually to bring about clarity of the situation. Then how the researcher can hypothesise and conceptualise scenario solutions. We then introduced the CATWOE test that

serves to establish who the customers and actors of the situation are, the ownership of the problem and the environment that surrounds and influences it. The worldview and transformation are shown to be at the heart of the development of conceptual models and how these can be refined before bringing the research back into the real world. The first of these models expressed the process as it is currently used by personnel in the fashion industries and the second expressed what we consider an improved situation. We gave some indication of how we used feedback that we had obtained through conducting a postal survey using appropriate personnel in the UK fashion and textile industries to test and validate the models and then to refine them.

Finally we outlined how the research has progressed in the last of the seven stages of the method and that this work continues to date. General feedback from the industry has enabled us to further refine the improved model and has provided a framework for the continuing research.

Soft systems methodology provided an effective method to further understand a current situation and to develop an ideal model. We feel that the method has been shown to be effective for investigating and testing complex human activities in the real world and that there is great scope for its use in other areas of design process and design practice research.

References

1. de Neufville R and Stafford JH (1971), S*ystems analysis for engineers and managers*, McGraw-Hill, New York.
2. Optner SL (1975), *Systems analysis for business management*,3rd ed., Prentice-Hall, Englewood Cliffs.
3. Optner SL (1973), *Ed Systems analysis*, Penguin Books, Harmondsworth.
4. Optner SL (1965), *Systems analysis for business and industry problem solving*, Prentice-Hall, Englewood Cliffs.
5. Checkland P (1981), *Systems thinking; systems practice*, John Wiley & Sons.
6. Checkland P (1999), *Systems thinking; systems practice*, revised ed., John Wiley & Sons.
7. Checkland P and Scholes J (1999), *Soft systems methodology in action*, new ed., John Wiley & Sons.
8. Checkland P and Scholes J (1990), *Soft systems methodology in action*, John Wiley & Sons.
9. Checkland P and Holwell S (1990), *Information, systems and information systems*, John Wiley & Sons.
10. Checkland P and Poulter J (2006), *Learning for action: A short definitive account of soft systems methodology and its use practitioners, teachers and students*, John Wiley & Sons.
11. Patching D (1990), *Practical soft systems analysis*, Pitman Publishing, London.
12. O'Connor J and McDermott I (1997), *The art of systems thinking: Essential skills for creativity and problem solving*, Thorsons, London.
13. Wilson B (2001), *Soft systems methodology: Conceptual model building and its contribution,* John Wiley & Sons.
14. Wilson B (1990), *Systems: Concepts, methodologies &* applications, 2nd ed., John Wiley & Sons.
15. Ackoff R (2010), *Systems thinking for curious managers*, Triarchy Press.
16. Dick B and Swepson P (1994), *Appropriate validity and its attainment within action research: an illustration using soft systems methodology,* http://www.aral.com.au/resources/sofsys2.html [last accessed 1st March 2012].
17. Pala O, Vennix JAM and van Mullekom T (2003), Validity in SSM: Neglected areas, *The Journal of the Operational Research Society*, **54** (7), 706-712.
18. Checkland, PB (1995), Model validation in soft systems practice, *Systems Research*, **12** (1), 47-54.
19. Abdullah R & Hubner R (2006), *Pictograms, icons & signs: A guide to information graphics*, Thames & Hudson, London.
20. Diane T and Cassidy T (2005), *Colour forecasting*, Blackwell.
21. Cassidy TD (2007), Personal colour analysis, consumer colour preferences and the colour forecasting for the fashion and textile industries, *Colour: Design & Creativity*, **1** (1): 6, 1-14.

22. Cassidy TD (2006), Exploring personal colour analysis data for the colour forecasting process, *Proceedings of the Interim Meeting of the International Colour Association*, 107-110, Misty Hills, Gauteng, South Africa.
23. Cassidy TD (2005), The collection of consumer colour preference data for the colour forecasting process. *Proceedings of the London College of Fashion Symposium*, 1-22.
24. Cassidy TD, Westland S and Grishanov S (2010), A colour selection system to better inform the colour forecasting process, *Proceedings of the International Foundation of Fashion Technology Institutes Conference*, Fu Jen Catholic University, Taipei, Taiwan.