

Films That Move Us: Moments of Narrative Impact in an Animated Short Film*

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Abstract: This article investigates the effects of films on an audience, using an interdisciplinary empirical approach connecting film analysis and psychophysiological measurement. It discusses the animated short film *Father and Daughter* (2000) directed by Michael Dudok de Wit. The features of the film that are relevant to the reception process, the so-called moments of narrative impact, are determined on the basis of Wuss's analytical film model. The model postulates that films can be described as a combination of different kinds of narrative structures that predetermine the reception, which is conceptualized as a process of problem solving. This article defines five moments of narrative impact. Three of these moments establish the main conflict and its possible solution while the other two combine reoccurring motives, the so-called topic lines. Heart rate and skin conductance reactions were examined for thirty participants. The results of heart rate measurements demonstrate a clear significance for a combination of topic lines. The establishment of the central conflict also evokes significant reactions.

Keywords: conflict, heart rate, motor mimicry, narrative structures, problem-solving, skin conductance

During film reception two complex and dynamic systems interact over time: the film and the embodied mind. Due to this complexity, it is difficult to assess the effects of films in an empirical way. The target of film-impact research is the analysis of a complex system of dynamic relations between aspects of films and aspects of their spectators. Film science is traditionally concerned with aspects of the medium. The investigation of effects of films on the recipients is

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*The reader might enjoy seeing the film in conjunction with reading the paper. The film is available on the web at <http://video.google.com/videoplay?docid=8073865125170809223#> (accessed August 12, 2010).

ascribed to the area of psychological research. Psychology benefits from a connection to film science, because the latter discipline is able to formulate theoretically founded descriptive models for the medium and its structures. Conversely, film researchers have become increasingly aware of the fact that most of the creative problems they deal with have no chance of being clarified if the psychological components of the effects of film art are not taken into consideration. Analytic film models and psychological models of the recipient have to refer to one another and have to be increasingly differentiated throughout the research process (Suckfüll 2000).

This article uses an interdisciplinary approach. A dramaturgical analysis of an original film is combined with a detailed analysis of the data acquired during reception. To be able to analyze the dynamic relations between film and recipient, researchers need the application of continuous measurements during the reception process. Physiological data offer that advantage. By means of physiological indicators it is possible to measure reactions to films immediately and sensitively. Results of questionnaires about the experiencing of films then show that reactions are later affected by cognitive reflection.

Wuss's Model of Narrative Structures

Wuss (1997, 2009) defines films as temporal arrangements of structural relations that probabilistically predetermine the reception process. Each cinematic composition can be approximated by determining three basic narrative structures and their combinations:

1) Within the causal chain significant events of the cinematic action are connected according to the principle of cause and effect. The spectator easily becomes aware of this linear-causal linkage of events. "Anyone analyzing . . . film, no matter whether for practical and artistic or for academic purposes, is . . . well advised to begin investigating the whole work by means of . . . reconstructing the causality of the course of events" (Wuss 2009: 61). The events that form the causal chain in Wuss's approach are the moments of conflict in the character's actions on the screen, which often mark the escalation of the protagonist's unique problem. Wuss terms these central turning points in the course of action "plot points."

2) Topic lines generate sense by the inner-textual variation of important themes or motives. The evidence of topic lines is low at the beginning of a film and increases with the frequency of repetition throughout a film. Topic lines differ in range, dispersion, and complexity. The term topic summarizes quite different circumstances. Often behavioral manners, that characterize the protagonists, are merged into different contexts (Wuss 1996: 61–63; 2009: 68–81). The most important criterion that Wuss establishes for the determination of topic lines is the intra-textual repetition of a motive. A successful analysis of topic lines in a film needs to describe the regularities at work and

to explain their function within the process of narration. According to Wuss similar configurations of stimuli in a film are often not consciously noticed by the viewers. Nevertheless the repetition can evoke latent expectations in the viewer's mind in the course of a "perceptual cycle" (Neisser 1976; Wuss 2009: 29, 70).

3) Narrative stereotype is the basic structure that is a result of the intertextual repetition of the same patterns in many films. "A film narrative always draws on the long cultural experience of storytelling" (Wuss 2009: 81). The narrative conventions of various genres can evoke strong hypotheses about the further development of the plot: "The viewer can count on a happy ending in a comedy, on a showdown between the opponents at the end of a western, on the capture of the perpetrator in a crime movie, etc." (Wuss 2009: 82–83). At first these structures are evident for the spectator but stereotype-based structures become increasingly inconspicuous due to habituation.

In most films all three principles of structure are at work in the organization of the narration. But narrative effectiveness is only given if the structures are substantially involved in the construction of the story. The narrative structures determine breaks within the cinematic process; consequently, they guide the reception process. The resulting segments are not to be understood as discrete units. What is meant is a relative discontinuity throughout the cinematic process. The most important moments of relative discontinuity in experiencing films are those scenes in which the basic narrative structures are combined and in which the central conflicts of a film become obvious for the audience. Wuss assumes that attention and arousal processes change significantly within such scenes. I call such scenes moments of narrative impact.

According to Wuss, the effects of isolated cinematic elements, for example a certain protagonist or a particular acoustic element, cannot be empirically concretized in an appropriate way without considering the narrative context. To investigate the effects of films on the spectator the first step is to determine a comprehensive model of the narration. Based on a detailed protocol of the film the exact occurrence, duration, and frequency of the three structures and their relations have to be defined.

Analysis of the Film *Father and Daughter*

The reasons for the decision to choose the animated short film *Father and Daughter* (2000) by the Dutch filmmaker Michael Dudok de Wit as a film example were manifold. Most important, the film could be expected to evoke strong reactions in the audience, to sadden it and to touch it deeply. This is one reason the film won an Academy Award in its category in 2001. Second, because it is a short film, which lasts approximately eight minutes, a detailed investigation of narrative structures and their effects on the spectators can be conducted using more appropriate research expenditure than would be the

case for a full-length film. Third, because it is an animated film, there are no famous actors and no dialogues that might cause additional effects.

The story of the film is centered on a human conflict. One day a father leaves his little daughter behind by rowing away in a boat for reasons we are not told. The daughter keeps coming back with her bicycle to the place on the shore from where her father's boat left. She is obviously longing for his return, but this does not occur, not even by the time the girl has become an old woman. She is shown in different ages and circumstances: as a child at dawn, as a young girl on a windy day, as a young girl when it is raining, as a young woman together with three girlfriends, as a young woman together with a boyfriend when night is falling, as an adult together with her man and two children, and as an old woman in winter time. Finally, as an old woman, she goes down the hill and into the water; she seems to commit suicide. But then the film switches to a dream world: The water changes to grass, and she finds her father's empty boat in it. She lies down in the boat, and then stands up and sees her father again; while running to him she becomes a child once more.

Two different kinds of conflict are connected in *Father and Daughter*: The central conflict that results from the father's leaving and the inner conflict of the daughter, which is intensified as it becomes increasingly clear that she cannot reconcile herself with the loss of her father. The conflict situation, in which the character is involved, is told in a terse and systematic way. The film shows a clear causal chain of two plot points, which are based on the aforementioned conflicts: 1) the father leaves his daughter at the beginning of the film, and 2) the resignation of the daughter, who has become an old woman in the end.

The narration is further structured by a main topic line: In a series of eight similar attempts the heroine returns on her bicycle to the place where her father left. There she looks out over the empty water and then rides away. Although these attempts seem quite different in their visual expression and temper, in terms of content and structure they prove to be very similar. The repetition of this motive enables the spectator to recognize that it is always the same protagonist, even though the daughter's age and appearance change. Each episode invariably leads to the same disappointing result. Thus, by the repetition of the invariant basic situation it becomes clear that the father's leaving represents an essential loss in the life of his daughter, and that her attempts to deal with this loss are futile. Therefore, I call this the motive of futility. A second topic line can be identified: On her way to or returning from the place where her father left, the daughter encounters people who are also on their bicycles. The fact that the daughter and the characters she meets are of different ages supports the illustration of the life phase the daughter is currently in. In five of the sequences belonging to this topic line the director uses a mechanism of perception: when two objects are moving toward each

other they are expected to collide. Because the protagonists in the film do not collide, I call this the motive of encounter. At the beginning of the film the director establishes a third topic line, which is repeated four times during the film. Again the director uses a mechanism of perception. The protagonist rides her bicycle uphill or upwind. We see the strain the protagonist is experiencing and we feel part of it ourselves. The scenes are able to elicit a motor mimicry in the viewers, a reaction that is similar to the physical and emotional behavior of the character.¹ I call this the motive of effort because it illustrates the enormous effort it takes the heroine to deal with the loss of her father.

It has to be kept in mind that only few spectators may be able to recognize the inner conflict of the heroine at once. Moreover it seems plausible that not every episode showing the futility of the attempts of the daughter to deal with the loss of her father causes significant reactions. The hypothesis is that the episodes causing the strongest reactions are those where the articulation of the motive of futility is additionally substantiated by incorporating further narrative structures. In one scene of the film the three topic lines are brought together and form an important moment of narrative impact. The second repetition of the motive of futility in the film is preceded by the motive of effort and then combined with the first appearance of the motive of encounter. The expectation of a collision in the motive of encounter is itself intensified by the fact that the motive of effort has already been established. At the start of this sequence, the daughter is shown riding her bicycle upwind and uphill. On her way back from the place where her father left, the daughter on her bicycle is blown forward by the wind and passes an old woman. The elicited motor mimicry prepares and enables a sensation of relief when the daughter passes the woman, which may be accompanied by eased laughter (Grodal 2002: ch. 8). In my opinion, the spectators are already involved in the film in a motor sense because of the introduction of the motive of effort in the very beginning of the film. Figure 1 shows screenshots of the motive of effort.

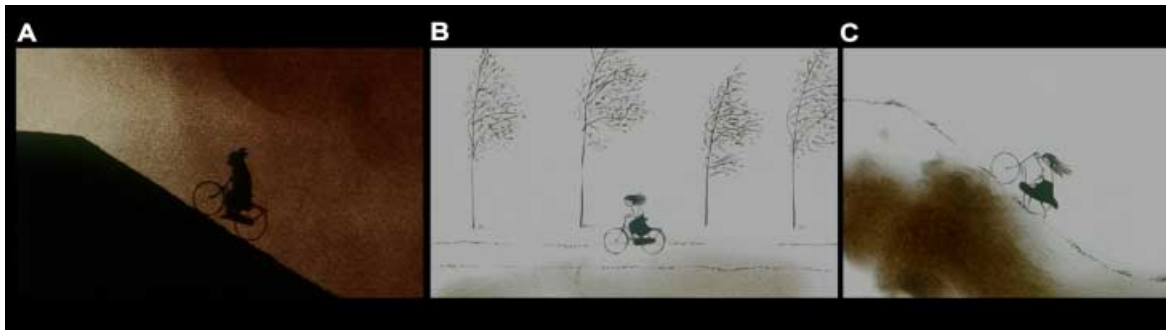


Figure 1. Screenshot examples for the motive of effort.

Figure 1A. For the first time in the film the daughter is on her way to the place where her father left (at 1 min 42 sec in the film).

Figure 1B. The daughter is on her way for the second time, riding her bicycle upwind (2:03).

Figure 1C. The daughter is on her way for the second time, riding her bicycle uphill (2:07).

In contrast, other repetitions of the motive of futility are reduced, as only parts of the sequence (riding to the place where her father left, looking out for her father, riding away with her bicycle) are shown on the screen, or the episodes are visually simplified, when, for example, only the light of a bicycle is shown. When the motive is repeated for the eighth time, all the spectators should recognize the inner conflict. Within this last repetition the director (again) uses humorous elements: A young girl meets the daughter, who is an old woman now. After the encounter the girl hops with her bicycle over a stone and the old woman rings the bicycle's bell. The hop over the stone can evoke, at least momentarily, motor mimicry in the spectators. The bell's ring creates a sense of relief, which may also be accompanied by eased laughter. Immediately after this scene the resignation of the daughter is shown on screen and is intensified by the preceding humorous elements. Thus, the last repetition of the motive of futility is combined with the motive of encounter and the relief intensified by stimulating motor mimicry and using humorous elements (Figure 2 illustrates the progression of the film's motives).

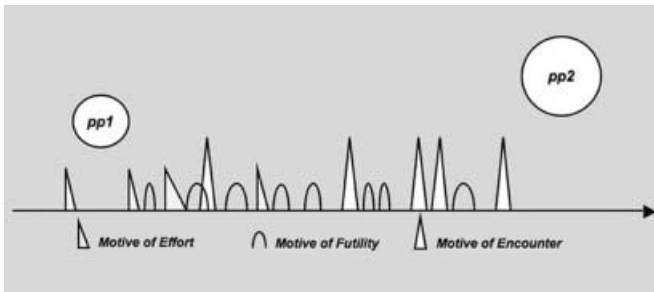


Figure 2. Illustration of the progression of the film's motives. Note: The symbols for the three motives represent all their instances in the film in their exact order.

With regard to narrational stereotypes, the film follows the laws of the melodramatic genre which, by preference, deals with unsolvable conflict situations in female protagonists. It uses redundant conflict constellations such as a child's loss of his or her parents or the lifelong waiting for a change of fortune. Other conventions of melodrama are the schematic sequence of the action and the musical reinforcement. The music certainly plays a very important role in *Father and Daughter*. According to Wuss's approach, acoustic or other formal elements do not cause effects per se. The narrative context is always of primary importance. Thus, music can help to highlight scenes in a film that are of central relevance to the story. In *Father and Daughter* each change over from one segment to another is reinforced by changes of the music. These turning points provide a clear segmentation of the film and thus help the audience to structure the plot. Nearly the whole film is accompanied by music and according to Wuss's approach the music is important for supporting the narration. Only in one scene is there silence. The daughter goes down the hill and immediately afterward she goes into the water, indicating that she commits suicide. The silence emphasizes the importance of the scene.

One may ask to what extent different persons would analyze a certain film and in particular its topic lines with the same results (inter-coder reliability). In fact, this is a problem. Wuss (2009: 68–69) states: "Their [the topic lines'] existence can often only be proven through exact observation and careful

structural comparisons between certain passages of a film. Their narrative function is often only barely apparent. . . . The problem is made even more difficult by the fact that this basic narrative structure has not led to any unified ideal types of narrative, even in cases when it is dominant. Thus there are no identifiable patterns from which one could orient oneself, but rather a broad field of different forms of narration, often referred to by terms such as episodic, epic, lyric, or open.”

Problem-Solving

Both the sequence of central events on screen and the viewers’ reception can be described as processes of problem-solving. Problem-solving is initiated when an unsatisfactory starting situation must be changed into a satisfactory situation, but obstacles make this difficult (Wuss 2009: 108). Conflict situations in films are in most cases problematic situations. The characters try to change an unsatisfactory situation into a satisfactory one, but they do not always succeed and barriers prevent an immediate solution. Wuss (2009: 138) points out that the reception of a film cannot simply be explained by claiming that the viewers share the characters’ problems. When the conflicts portrayed in a film are able to involve the viewers in the problem-solving process, the reason in his view is that humans constantly follow a primary motive that has been referred to as the “need for control” of their environment (Dörner 2004; Dörner et al. 1983). Real-life situations require active control in order to change events in the environment. In film reception the viewer cannot change the course of events of a film, but he or she can at least attempt to gain passive control in the sense of anticipating upcoming events. This differentiation in terminology offers considerable advantage in understanding the cognitive and emotional dimensions of cinematic experience. The passive control the

spectator attempts to retain during the reception of a film is not passive at all. Even if we cannot completely foresee the flow of events, we are mentally activated. Wuss (2009: 139) argues that the viewers intuitively try to make good guesses about how things will develop because they want to overcome the uncertainty about how the conflicts will be solved. The simulated conflict situation on the screen provides for the stimulation of

mental activation, and the drive for passive control seems to be a fundamental component of appraisal; that is an assessment of the situation in relation to its subjective meaning for the individual, which is then related to action readiness (the possibilities a person has to react to changing conditions). This view is compatible with recent approaches to emotions elicited by films, for example according to Tan “an emotion may be defined as a change in action readiness as a result of the subject’s appraisal of the situation or event” (1996:

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46; see also Frijda 2006 and Scherer 2001). The stylized plot of *Father and Daughter* shows the heroine in a problematic situation, in which a satisfactory solution is not reached even over the course of decades. The essential problem of the daughter is not immediately obvious, but has to be discovered by the viewer throughout several episodes. At one point in the film it seems that the daughter may reconcile with the loss of her father, when she comes to the shore with a man, sitting on the backside of his bicycle—probably the man she loves. It is important that the daughter and her friend do not stop at the place on the shore and she does not look out for her father. (For a very short moment she lifts her head.) The scene represents the fifth repetition of the motive of futility.

Before we can solve a problem, we first have to identify it (Bransford and Stein 1984: 12). This notion is important for a more detailed specification of the impact of the two plot points in *Father and Daughter*. Plot point 1 (the father leaves his daughter) is realized in five steps: a) the father embraces his daughter for the last time; b) the father rows away with a boat; c) the daughter, left alone at the shore, runs in an excited manner from side to side; d) pictures of the landscape are shown; e) the daughter rides away on her bicycle. At least in step c) the attentive viewer should recognize the problem that the father probably is not going to return. The conflict of the daughter is intensified by showing her despair and excitement. Plot point 2 (the resignation of the daughter) is realized in six steps. The plot point is announced by representing her resignation: a) the bicycle falls down for the first time and the daughter picks it up; b) the bicycle falls down for the second time; c) the daughter leaves the bicycle on the ground and goes down the hill. The next scene is particularly important for the problem-solving process: d) she goes into the water. The resignation of the daughter is brought to a conclusion when she appears to commit suicide (step d). During the following scene the viewer realizes that it is suddenly not water, but a field of grass. At this time the director switches from reality to a dream world in which everything is possible: e) the daughter lives and finds a boat in the grass, and finally f) she lies down in the boat. The viewer may conclude that now she just sleeps (or rests) in peace, perhaps accepting that she cannot reconcile herself to the loss of her father.

Physiological Measurement

How can we measure the effects? “Wherever conflicts . . . appear in a film plot, they will most likely lead to measurable changes in the level of activation in the viewers and thus make it easier to analyze emotional reactions” (Wuss 2009: 153). Three levels of measurement can be differentiated: 1) the experiential level, where emotional effects become conscious and can thus be verbalized; 2) the expressive level, where concrete behavior including the extremes

of laughing or crying can be observed; and 3) the physiological level that includes changes of cardiovascular activity, of skin conductance, of respiration as well as of brain activity (Mauss and Robinson 2009).

An aspect of emotion is that the body acts. “The heart pounds, flutters, stops and drops; palms sweat, muscles tense and relax . . . faces blush, flush, frown and smile” (Bradley and Lang 2000: 581). Many studies have shown that changes of physiological parameters accompany variations in attention. One common finding is that heart rate (HR) decreases in the fore period of a reaction time task or, more generally, briefly before an expected event. Thus, a decrease in HR can be seen as an indicator of the initiation of an attentional state (Andreassi 1995: 235). Lacey and Lacey (1978) provided an explanation of the role of HR deceleration in attention processes. In their view, the biological meaning of decrease in cardiovascular activity within active stimulus intake facilitates attention processes by increasing brain activity (Andreassi 1995: 347–348). Thus, HR deceleration may be a constituent of a biological optimization process. Graham and Clifton (1966) noted that the orienting reaction (OR) was accompanied by HR deceleration and HR acceleration most likely represented a defense reaction (DR) to aversive stimuli. “There is good support for the hypothesis that HR deceleration is associated with the OR and stimulus intake, whereas HR acceleration accompanies the DR and stimulus rejection” (Andreassi 1995: 237).

A biphasic approach to emotion posits that emotion fundamentally stems from varying activation in centrally organized appetitive and defensive motivational systems that have evolved to mediate the wide range of adaptive behaviors necessary for an organism struggling to survive in the physical world. Arousal, in this context, can be defined as the intensity of activation in the motivational systems (Lang, Potter, and Bolls 2009: 196). The most common current conceptualization of arousal associates it quite narrowly with activation in the sympathetic nervous system. This allows for easy measurement, because skin conductance (SC) is completely and solely innervated by the sympathetic nervous system. SC is an excellent measure of the arousal dimension of emotion (Lang et al. 2009; see also Kreibig et al. 2007 and Ravaja 2004). Measuring SC reactions means to measure the changes in the activity of the sweat glands on the palm of the hand. The skin momentarily becomes a better conductor of electricity when stimuli occur that are physiologically arousing. The advantage of physiological recording is that an over-time record of changes in the system is produced that can be time-locked to a media message presentation. Thus, significant reactions can be ascribed to certain features of a film.

It is important to keep in mind that even though both HR and SC are sensitive indicators for psychological processes, the significant changes in these two parameters often do not correspond. Many studies indicate different va-

lidity of HR and SC but the findings do not allow a mandatory interpretation. Boucsein (1988: 295) states that SC is a sensitive indicator for lower and cognitively stimulated activation, whereas HR stands for higher levels of activation that are combined with motor activity, that is the (felt) necessity to act.

Hypotheses

Based on the above-mentioned theoretical considerations, I define five scenes from *Father and Daughter* as moments of narrative impact (see Figures 3 and 4). According to Wuss's assumptions, I expect significant changes in heart rate and skin conductance reactions within the relevant time intervals of the film.

1) Plot point 1 establishes the external conflict. The part in which the daughter is shown left alone at the shore allows a clear identification of the problem (step c).

2) In plot point 2 the resignation of the daughter is brought to a conclusion. The part in which the daughter goes into the water clearly illustrates the problem that she cannot reconcile herself with the loss of her father (step d).

3) A combination of the motive of effort, the motive of futility, and the motive of encounter results in a scene which is strongly intensified by motor mimicry and thus enables a relief for the audience. On her way back from the place where her father left, the daughter on her bicycle is blown forward by the wind and passes an old woman. I call this moment of narrative impact relief 1.

4) A second scene in which the topic lines are combined and motor mimicry allows for a relief precedes plot point 2. A young girl meets the daughter, who is an old woman now. After the encounter the girl hops with her bicycle over a stone. The old woman rings the bell of her bicycle (relief 2).

5) In the process of problem-solving, a fifth scene became particularly important for the narration. When the daughter comes to the place on the shore with a man she loves (first step), combined with the fact that she does not look out for her father (second step), a possible solution is indicated. I call this scene solution.

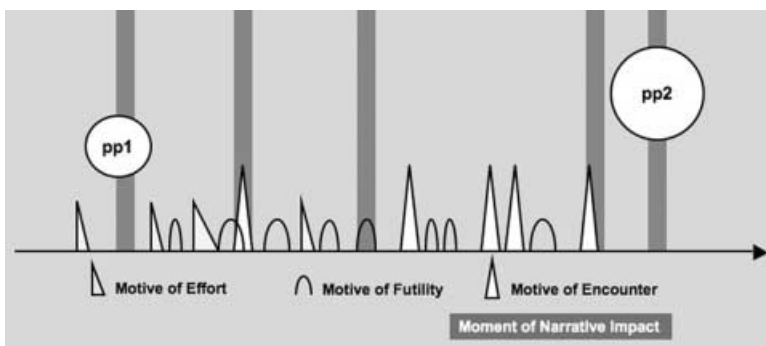


Figure 3. Illustration of the film's analysis including moments of narrative impact. Note: The bars illustrate the five moments of narrative impact. They are indicated in the exact order. The first bar represents the first moment of narrative impact which is equivalent with the first plot point. The last moment of narrative impact is equivalent with the second plot point. The three bars in between represent the moments of impact relief 1 (second bar in the chart), solution (third bar), and relief 2 (fourth bar).

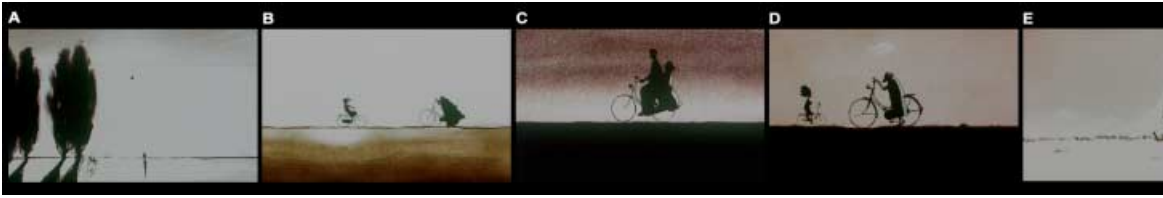


Figure 4. Screenshots for the five moments of narrative impact.

Figure 4A. Plot Point 1: The daughter is shown left alone by her father (1:19).

Figure 4B. Relief 1: The daughter's way back from the place on the shore is intensified by motor mimicry and thus enables relief for the audience (2:28).

Figure 4C. Solution: The daughter comes to the place on the shore with a man (3:46).

Figure 4D. Relief 2: A young girl meets the daughter, who is an old woman now. After the encounter the girl hops with her bicycle over a stone (5:39).

Figure 4E. Plot point 2: The daughter goes into the water (6:07).

The Empirical Procedure

Overview of the Study

Thirty participants watched the short film. During reception their HR and SC were measured. For those participants who consented to be videotaped, facial behavior was recorded with a camera. After the measurement interviews were conducted.

Film

The short film was preceded by a cinema-like program in order to allow the participants to adjust to the unfamiliar situation. The preprogram consisted of commercials and movie trailers, which constituted a coherent and common program without any salient components differing from the usual sequences recipients are confronted with in regular reception situations. To separate the short film from the previous program and for reasons of synchronization of the film with physiological measurement, it was preceded by a countdown from 10 to 1. As context information may amplify the impact, a standardization of instructions is worthwhile. The participants were told that they would see a program consisting of commercials, film trailers, and an animated short film titled *Father and Daughter*.

Participants

The sample consisted of thirty-one participants, seventeen women and fourteen men. One person had to be completely excluded from the analysis because he did not agree with the instructions. Mean age was 26.20 years (standard deviation SD = 5.14). The participants were recruited in the context of a seminar. Most of the participants (n = 25) were studying at The Berlin University of the Arts. The frequency of going to the cinema ranged between three times per year to three times per month. Half of the sample watched

movies in the cinema one to two times a month. None of the participants had seen the film and all participated voluntarily in the investigation. All participants reported to be healthy and free of any medication. There was no payment for participation.

Equipment

The program was presented on a 19-in. diagonal computer monitor at a viewing distance of one meter (about three feet) in a room with low ambient light. To record the facial behavior of those participants who consented to be videotaped, a camera was positioned behind the monitor. Participants were seated upright in chairs. Physiological data were collected with a transportable measurement system.² For measurement of HR it was necessary to attach three electrodes to the upper part of the body (sternal placement). For the measurement of SC two Ag/AgCl-electrodes filled with isotonic electrode paste were attached to the thenar and hypothenar eminences of the palm of the non-dominant hand. The participants' forearms were placed on armrests.

Procedure

The study was conducted in the summer of 2007. All dates were arranged for the evening between 5:30 and 8:30 p.m. in order to control for possible differences caused by the time of day. Data recording was conducted individually for each participant. Each session was supervised by the same (female) experimenter. Within the agreement the participants were asked to keep to their usual sleeping time and to avoid excessive alcohol, nicotine, and caffeine consumption before their experiment date. They also indicated their agreement or disagreement to be videotaped. The conditions of the situation were standardized for all participants. At the outset participants answered a short questionnaire to assess film experience and socio-demographical data. Then the physiological sensors were attached and during that procedure short and easy to understand information about the physiological measurement was given. The participants were asked to find a comfortable sitting position. As motor activity can produce artifacts in cardiovascular and skin conductance records, the participants were reminded to avoid any unnecessary movement and speech. During the session the experimenter sat two meters (about six feet) away from the participant. Movements were registered by means of a keyboard that is part of the measurement system. Thus, artifacts caused by movements could be paralleled exactly with the physiological reactions and be removed for the analyses. Then the participant started viewing the preprogram and the short film. Physiological data was continuously sampled during the presentation of the program. Finally, the participant was disconnected from the measurement device. Each participant's liking of the film and self-reported emotional experience were assessed during a personal interview

conducted after a short recreation phase right after the measurement. One session lasted approximately forty-five minutes.

Data

Heart rate (HR) was measured in beats per minute (bpm), skin conductance (SC) in microsiemens (μS). For each participant a time series of 455 1-second intervals for HR and a time series of 455 1-second intervals for SC-amplitudes³ were available. This data was standardized.⁴ All independent variables—that is, the moments of narrative impact—were defined as 0/1-coded dummy variables. Altogether the effects of plot point 1 (in 5 steps), plot point 2 (in 6 steps), relief 1, relief 2, and solution (in 2 steps) were tested. The data was analyzed by regression analysis. Regressions analysis is a statistical procedure that enables researchers to predict and to explain the values of dependent variables (e.g., heart rate and skin conductance) by a number of independent or predictive variables (e.g., moments of narrative impact).

Results

Heart Rate

Individuals differ in their evaluation and thus their response to identical stimuli (Andreassi 1995: 237). One participant may react with a deceleration in heart rate. Another participant may show acceleration within the same time interval. This may be an argument for analyzing individual processes. Conversely, a considerable amount of variation in the cardiovascular pattern can be caused by, for example, respiratory sinus arrhythmia (Andreassi 1995: 227–228). Thus, a deep breath could influence HR. One may argue that even a deep breath can be considered as a reaction to a certain stimulus. But in general it has to be stated that individual HR processes could be biased. Therefore, HR data should also be analyzed in the aggregate status, because a common process for all participants or for groups of participants will neutralize the variance in cardiac pattern, which is caused by other physiological functions. However, one must be aware of the fact that a common process will also neutralize specific characteristics of individual processes. Table 1 (heart rate column) summarizes the results for the common process.

The first hypothesis was that there would be significant reactions to plot point 1, in which the central conflict of the film is established. As expected, only the sequence in which the daughter, left alone at the shore, runs in an excited manner from side to side (step c) caused a significant deceleration in HR. The analysis of plot point 2 reveals significant changes in heart rate as specified in the hypotheses for step d) when the daughter seems to commit suicide; but also for step b), when the bicycle falls down for the second time, step e), when the daughter seems to live and finds a boat in the grass, and step f) when she lies down in the boat, the parameter estimates are significant and

Table 1. Results of a multiple regression analysis for moments of narrative impact as predictors for changes in heart rate and skin conductance

Moments of Narrative Impact as Predictors	Heart Rate (β)	Skin Conductance (β)
Plot Point 1a)	-.037	-.001
Plot Point 1b)	-.005	.033
Plot Point 1c)	-.054**	.042
Plot Point 1d)	-.002	-.039
Plot Point 1e)	-.015	-.051
Plot Point 2 a)	-.001	.093*
Plot Point 2 b)	-.045*	.058
Plot Point 2 c)	-.038	.014
Plot Point 2 d)	-.057**	-.042
Plot Point 2 e)	-.081***	-.080
Plot Point 2 f)	-.065**	-.008
Relief 1	-.072***	.207***
Relief 2	-.014	.001
Solution a)	-.024	-.039
Solution b)	.017	.068

Notes: The β values are the so-called standardized regression coefficients. They indicate to what extent each moment of narrative impact influences heart rate and skin conductance. Asterisks indicate that the effect is statistically significant. $\beta = -.081^{***}$ for the predictor plot point e and $\beta = -.072^{***}$ for the predictor relief 1 indicate that these moments of narrative impact have the strongest effect on heart rate. In the skin conductance data the strongest effect is measured for relief 1 ($\beta = .207^{***}$).

indicate HR decelerations in all cases. The moment of narrative impact (relief 1) causes a pronounced deceleration in HR, whereas the values for relief 2 are not significant. The two steps of the fifth moment of narrative impact (solution) also did not cause significant reactions in HR.⁵

The moments of narrative impact may have caused heart rate decelerations in one participant, and heart rate accelerations in another participant. When the values for each 1-second interval for all the participants are added together, the overall result may be biased, as negative (decelerations) and positive (accelerations) values cancel each other out. Therefore, a closer look at the individual responses may be helpful for the interpretation of the results. Thus, I have additionally conducted regression analyses for each individual time series of HR. The values for the plot points were negative in nearly all cases, that is the participants showed decelerations of HR. Positive reactions, that is HR accelerations, were found especially for the scenes in which the bicycle falls down (plot point 2, steps a and b). The individual reactions to relief 1 were exclusively negative, whereas for relief 2 no significant values at all appeared. Solutions a and b caused deceleration as well as acceleration.

Skin Conductance

The dependent variable for the analysis of the SC data is a time-series of 455 skin conductance reaction (SCR)-amplitudes—one average value (for all participants) for each second of the short film. Across the entire sample the SCR-amplitudes are significant only for plot point 2, step a, the scene in which the daughter's bicycle falls down for the first time and for relief 1. Table 1 (skin conductance column) summarizes the results.⁶ Clear evidence for the impact of the scene relief 1 is recognizable in the skin conductance data when regarding the number of significant SCRs. Half of the participants exhibited a significant reaction at this moment in the film (see Figure 5).

Discussion of the Results

This study examined changes in attention and arousal operationalized by physiological parameters of HR and SC indicating effects of dramaturgically relevant scenes in an animated short film. The goal was to describe the so-called moments of narrative impact based on an analysis of narrative structures, conflict situations on screen, and problem-solving processes as a tableau for reception and, finally, to prove the effects of such moments of narrative impact on the spectators. The analysis revealed at least one strong moment of narrative impact that is defined by a combination of three topic lines,

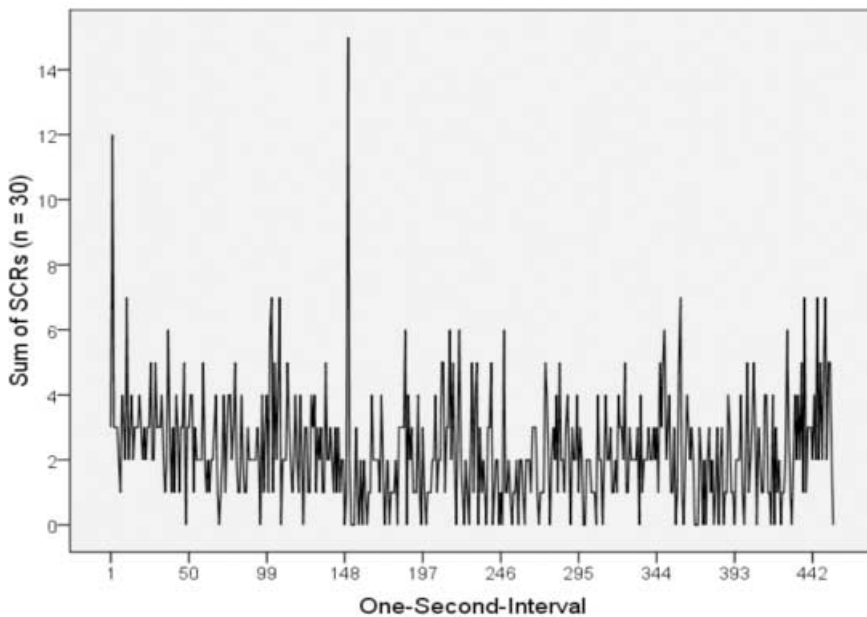


Figure 5: Time plot of number of SCRs in 1-second-intervals ($n = 30$).

Note: The eye-catching spike indicates that exactly in second 150, half of the sample shows significant skin conductance reactions. Significance means that the intensity of their reactions, measured as amplitudes of the reactions, is considerably stronger than on average.

according to Wuss's model of narrative structures (relief 1). A comparable scene that appears later in the film (relief 2) does not cause significant reactions in either of the measured parameters. A possible interpretation is that the audience already is aware of this stylistic feature. A wear-out effect may be the reason for the fact that no significant reactions could be observed. Another possible interpretation is that the first moment of relief is staged more impressively on the visual level. The strong wind blowing the young girl's body forward amplifies the dramaturgical effect to a certain extent. The resulting motion is the strongest one in the whole film. In contrast, the second moment of relief is staged in a more calm and subtle manner.

The results for other moments of narrative impact are contradictory. They show up in HR, but not in the SC data: The HR data indicate significant reactions to both plot points that form the causal chain of the film. However, the data show remarkable reactions for further steps of plot point 2. When the bicycle falls down for the second time (step b), perhaps the expectation of a conflict solution is generated and causes a significant change in HR. It also seems relevant that the participants exhibited diverging emotional reactions to this part of the film. Although some reported having empathized with the old woman and described the moment as sad and tragic, others saw a comical element when her bicycle falls down repeatedly and they laughed. Within the final scenes of plot point 2, the director switches from reality to a dream world. The daughter is shown alive after her presumed suicide, finds the boat, and lies down to sleep or to die. These scenes also cause significant changes in HR, maybe because the viewers think this is the open solution of the conflict and the end of the film. All parameter estimations for the steps of the plot points indicate HR decelerations that could be interpreted as stimulus intake. The results for the SC data did not correspond to the HR data. Significance was revealed only for the scene in plot point 2, in which the bicycle falls down for the first time (step a). This corroborates Boucsein's (1988: 295) observation that changes in the HR may be an indicator for higher levels of activation combined with motor activity. In other words, perhaps HR is a better indicator for this film, which elicits strong emotions and intentionally causes motor mimicry in the viewers.

The first scene in the film, in which a possible solution of the conflict is indicated (the daughter passes with a friend the place from where her father left) does not reveal significant reactions in either of the measured parameters. However, regarding the individual processes, pronounced HR decelerations as well as accelerations for many participants of the study were registered. Finding no significant reactions within the aggregated process does not mean that there are no significant reactions at all. The viewers just evaluate scenes in different ways. For example, the scene with the friend can possibly evoke an aversive reaction in some participants, because it is seen as

a cliché when a woman's relation to her father is transferred onto another man. Furthermore, it has to be considered that some of the participants reported that they did not understand the end of this scene. They did not recognize that the bright spot on the screen was the light of the bicycle moving away. The resulting confusion is likely to have caused diverging reactions on the physiological level, not only in the participants who explicitly reported their confusion in the interview, but possibly in more participants who did not mention this because of social desirability.

Implications for Theory

Overall the results indicate that *Father and Daughter* involves the spectators by eliciting motor mimicry. The finding that such preparations result in significant reactions to dramaturgically relevant scenes would not have been possible without starting from an analysis of narrative structures on different levels, especially the topic lines in Wuss's model. His film analytic model, in which three levels of narrative structures are differentiated, and his idea of identifying conflicts on screen by conceptualizing the film and consequently the reception as a process of problem-solving are promising approaches. The value of this study for film science is that the effects of topic lines could be objectified empirically. It is not a matter of course that combinations of more inconspicuous and relatively unconsciously received cinematic structures show measurable effects on the spectators. Wuss's model provides an elementary typology of narrative structures. However the model has to be further developed. Reliable criteria for the definition of the narrative structures have to be extracted by using the immense corpus of film analytic examples provided by Wuss (2009). The idea to conceptualize films and their reception as a process of problem-solving has led to the specification of moments of narrative impact for which significant reactions showed up in the heart rate data, though only partially in the skin conductance data. Besides the fact that heart rate may be a better indicator for the film under consideration, it is important for future analyses to precisely define the different steps of the realization of problems and their solutions in films: the announcement, the first hint, the second more clear articulation of the problem or the solution.

Recent theories claim that emotions elicited by films can be defined as "a change in action readiness as a result of the subject's appraisal of the situation or event" (Tan 1996: 46). The assessment of a conflict situation on the screen in relation to its subjective meaning for the individual (appraisal) is related to the possibilities of a person reacting (action readiness). *Father and Daughter* allows for motor mimicry; the spectators experience factual physical activity; they experience a readiness to act,

The idea to conceptualize films and their reception as a process of problem-solving has led to the specification of moments of narrative impact for which significant reactions showed up in the heart rate data . . .

which is a fundamental component of (strong) emotions. Thus, the further development of emotion theories for film should incorporate a perspective on motor mimicry.

Implications for Methodology

Physiological measurement during reception is promising because continuous variables allow exact statements about the effects of certain aspects of films. Physiological parameters are direct and extremely sensitive measures that require no words. However, an improvement in data acquisition is possible:

1) In future studies participants should be informed which film they will watch. They should be provided with brief information as in TV or cinema programs. For reasons of ecological validity this is a better solution than leaving the participants uninformed; in the usual reception situation viewers are informed, at least to a minimum (Tan 1996: 9–11).

2) In future studies the laboratory situation needs to be more equivalent to the reception situation in the cinema. The participants should sit in front of a screen in a cinema chair. The experimenter should watch the participants from an adjacent room to minimize his or her influence. Not only facial behavior but also body movements should be recorded, in order to be able to control for artifact as a consequence of such movements. Moreover, the body movements are potentially important indicators for emotions and their intensity. Motor reactions do not necessarily have to be visible to the researcher. Electromyographic measurement is a further option to register those muscular actions that cannot be seen.

3) Interviews are necessary for an analysis of the reasons for the reactions of the recipients. A standardized analysis of the physiological data can make the first results available very quickly and thus offer the possibility of showing the participants their physiological data and talking with them about the scenes in the film that caused particularly strong reactions.⁷

The subjects whose faces we were allowed to videotape showed various facial reactions. These reactions were analyzed in a first exploratory attempt using the Facial Action Coding System (FACS; Ekman, Friesen, and Hager 2002) by a certified coder. Only a few participants showed facial cues for sadness. On the contrary, many of the facial and bodily reactions indicated that emotional involvement was being controlled in different ways. Some displayed the so-called eye blinks as part of a startle reflex (Landis and Hunt [1939] 1968). Abrupt head movements occurred. Facial cues for annoyance or irritation (lowering the eyebrows, tightening around the mouth, pressing the lips together) were found. Some were holding their hand in front of their mouth. Ekman and Friesen (1969, 1972) argue that self-touching has the function of coping with emotions (Harrigan 2008). These first explorative results are

compatible with Wuss's theoretical considerations about emotions elicited by films when he underlines the relevance of a need for controlling emotions.

Implications for Practice

In comparison to the registration of eye movement (Smith and Henderson 2008) or brain activity (Hasson et al. 2008), HR and SC are easy to measure. Research expenditure and costs are relatively low. In combination with interviews and an analysis of the facial and bodily actions for those scenes that cause strong effects, the elicited emotions can be described in a more detailed way. In the reported study hypotheses concerning the effect of moments of narrative impact on screen were examined. For practical issues an extensive exploration is possible. Principally, for each film episode a 0/1-coded variable can be created and the effects on the viewers can be checked. The strategy of data analysis can be routinized. Under these conditions the method seems to be suitable for application during the production phase of a film and thus may be of interest to the film industry.

In this study the analysis was conducted for the whole sample. Inter-individual differences were not examined. However, the effects of a given film vary across target groups. Thus, the next step within the inter-disciplinary process is to permit a more differentiated view of the distinction between well-defined groups of recipients of fictional narrative. In consecutive studies I developed a construct, the so-called modes of reception, which can illustrate these differences better than socio-demographic data or media-use data (Suckfüll 2004; Suckfüll and Scharkow 2009). Modes of reception are a four-dimensional construct with the factors "identity work," a comparison of the self with the film characters and their vital issues; "in-emotion," the readiness to sink into a movie and to live out feelings; "imagination" of alternative plot lines; and "production," a mode of reception that is characterized by directing the attention to elements of film production. I am currently continuing the study of *Father and Daughter* under better conditions (including the registration of facial and bodily actions) and with a bigger sample, stratified according to modes of reception. I hope to explain the differences in reception processes by means of modes of reception to determine the differentiation of target groups, a process that may be of interest especially for film-marketing issues.

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film studies and psychological research using psycho-physiological measurement. Moreover, I thank Diana Mirza, who did the data collection, and Flavia Bleuel, who coded the facial expressions.

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Notes

¹ The concept of motor mimicry has been much strengthened in recent years through the discovery of mirror neurons by neuroscientists (see Gallese and Stamenov 2002).

² The measuring device used is a product of the company PAR Elektronik, Berlin, Germany.

³ The integrated software of the measurement device used provides only the number of skin conductance reactions (SCR), which exceed a defined criterion for the 1-second interval in which the reaction reaches its highest value. Therefore the amplitudes for SCR were calculated by using special software. As the SCR caused by a certain stimulus reaches its amplitude after an individually differing latency, I ascribed the amplitudes that exceeded a criterion of $0.05 \mu\text{S}$ to the 1-second interval in which the reaction begins. But there still may remain an individual latency between the stimulus and the beginning of an SCR. This has to be kept in mind for the statistical analysis.

⁴ The data are individually z-standardized. This transformation is necessary for comparability of the participants, whose physiological data have different baselines and variances.

⁵ In time-series data a certain value is often a function of the preceding values. Therefore the time-series of the preceding values was introduced as a further predictor. The very high value $\beta = 0.794$ for this predictor indicates that the HR data heavily depend on the preceding values.

⁶ As a latency period between stimulus and reaction is possible in SC data, that is reactions may appear with a delay, I conducted an additional analysis of the time-leaded SCR-amplitudes (1 and 2 seconds). This procedure does not reveal further significant estimates for the defined moments of narrative impact.

⁷ In the meantime I have built a laboratory that combines these and other improvements (see <http://www.ir-lab.de>).

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