Brief article

Categorizing moving objects into film genres: The effect of animacy attribution, emotional response, and the deviation from non-fiction

Valentijn T. Visch\textsuperscript{a,}\textsuperscript{*}, Ed S. Tan\textsuperscript{b}

\textsuperscript{a}Industrial Design, Technical University Delft, Department of Arts, Vrije Universiteit Amsterdam, The Netherlands
\textsuperscript{b}Amsterdam School of Communications Research, University of Amsterdam, The Netherlands

\textsuperscript{*}Corresponding author.
E-mail address: mail@valentijnvisch.nl (V.T. Visch).

\textbf{Article info}

\textbf{Article history:}
Received 13 July 2006
Revised 10 October 2008
Accepted 24 October 2008

Keywords:
Genre
Movement
Emotion
Animacy
Categorization
Motion picture

\textbf{Abstract}


In an animated film scene portraying a chase, movements of the chasing object were systematically varied as to parameters: velocity, efficiency, fluency, detail, and deformation. The object movements were categorized by viewers into genres: non-fiction, comedy, drama, and action. Besides this categorization, viewers rated their animacy attribution and emotional response. Results showed that non-expert viewers were consistent in categorizing the genres according to object movement parameters. The size of its deviation from the unmanipulated movement scene determined the assignment of any target scene to one of the fiction genres: small and moderate deviations resulted in categorization as drama and action, and large deviations as comedy. The results suggest that genre classification is achieved by, at least, three distinct cognitive processes: (a) animacy attribution, which influences the fiction versus non-fiction classification; (b) emotional responses, which influences the classification of a specific fiction genre; and (c) the amount of deviation from reality, at least with regard to movements.

© 2008 Elsevier B.V. All rights reserved.

1. Introduction

The reported study follows the footsteps of Heider and Simmel (1944) who demonstrated the role of object movement in the attributions of life-likeness to figures. It goes one step further in studying the categorization of film scenes as to genre as a function of object movements. We presented two animated abstract blocks involved in a chase, varying five parameters of movement, and registered: (1) animacy rating, (2) emotional responses, and (3) genre categorization as non-fiction, drama, action, and comedy.

The importance of genre knowledge and recognition for film viewers seems uncontested. Genre recognition primes (Roskos-Ewoldsen, Roskos-Ewoldsen, \& Dillman-Carpentier, 2002) and directs (Zwaan, 1994) attention, affects modes of perception (Hawkins et al., 2005), generates narrative expectations (Grodal, 1997) and emotions (Smith, 2003; Tan, 1996; Zillmann, 1988). Genres can be accurately recognized by stylistic features as Hayward (1994) showed for the literature, Dalla Bella and Peretz (2005) for music and Visch and Tan (2007, 2008) for film. However, the particular attributions and cues viewers use to arrive at a genre classification remain unclear. This study focuses on
the role of perceptual movement characteristics, animacy attribution, and emotional response in genre categorization. Four major genres were selected namely comedy, drama, action, and non-fiction. Originating in mythology (Frye, 1957) and known at least since Aristotle (Trans., 1988), these genres have stood significant historical period and media shifts.

It may be assumed that in categorizing film as to genre, viewers use attributions to objects in motion at various levels of complexity. At a low level, animacy is involuntarily attributed. Objects seen as animate are visually processed in the STS region (Beauchamp, Lee, Haxby, & Martin, 2003), which in turn facilitates higher-order attribution such as emotions and intentions (Blakemore & Decety, 2001; Scholl & Tremoulet, 2000). Automated animacy detection is an adaptive capacity, supporting early identification of living entities as prey, predators or mates (Allison, Puce, & McCarthy, 2000; Schultz, Friston, O'Doherty, Wolsert, & Frith, 2005). Perceptual criteria proposed for animacy include changes of speed and direction (Tremoulet & Feldman, 2000), intention ( Dittrich & Lea, 1994), goal orientation (Opfer, 2002), and displayed interactivity between the objects ( Schultz et al., 2005). The stimuli we used meet all proposed criteria for animacy attribution, and in addition their motion patterns suggest a particular intention, namely chasing (Barrett, Todd, Miller, & Blyth, 2005; Blythe, Todd, & Miller, 1999). A question this study purports to answer is how animacy varies as a function of movement characteristics. As to its role in genre categorization we predict that animacy enhances the recognition of film realism, because moving objects that are clearly artifacts seem to be realistically alive and socially aware (Heider & Simmel, 1944; Michotte, 1946/1963, 1950/1991). Hence, our animacy hypothesis: animacy attribution correlates positively to non-fiction genre attribution.

Emotions may serve as a somewhat higher level cue to genre categorization. Genres are said to be organized according to the particular emotions they typically elicit (Aristotle, Trans., 1988; Carroll, 2003; Grodal, 1997). Comedy evokes mirth, action impresses the viewer, and drama seeks to elicit tender emotions (Oliver, 2008), whereas non-fiction does not try to evoke emotions, but instead conveys an argument (Nichols, 2001). We expect that it is not paired with any emotion, though in our case the chase might invoke fear or admiration. Our emotion hypothesis then reads: genre categorization (comedy, drama, action, and non-fiction) correlates with distinct emotion responses (respectively, funny, sad, impressive, and scary). To complete the view on the emotional responses to movements, three emotions (aesthetic liking, surprise, and fascination) were added to the set of genre-specific emotions.

Finally, at the highest complexity level we propose that a distinction between fiction and non-fiction is crucial for genre categorization. The distinction is pragmatically fundamental in that non-fiction might have direct implications for viewers’ personal lifes, whereas fiction allows them to lean back and appreciate the story and aesthetic properties of a film. The distinction may be based on the perceived degree of the transformation of reality. Non-fiction transforms the actual world only minimally (Branigan, 1992; Corner, 1995; Nichols, 2001), whereas fiction is supposed to transform it to a higher degree, with references to reality being indirect and metaphorical (Branigan, 1992; Dewey, 1934; Goodman, 1984; Singer, 1998). We propose, then, that the extent of transformation of the actual world is perceived as a genre characteristic, with non-fiction acting as a baseline. Our realism hypothesis predicts that untransformed movements will be categorized as non-fiction in the first place, and as fiction, i.e. drama, action, and comedy, in the second.

In addition, a more precise ranking in terms of fidelity to realism can be predicted. The drama genre’s transformation of reality is slight, thus facilitating empathy (Gaut, 1999). Drama portrays the reality of everyday life (Lacey, 2000; Neale, 2000) and is characterized by realistic acting (Hallam & Marshment, 2000). The action genre has a minimal similarity with reality allowing for thrilling conflicts, while certain elements are enhanced in comparison to non-fiction (e.g. physical action, determination, and efficiency (Bordwell, 2006; Neale, 2000). The comedy genre’s relation to non-fiction is the most remote: surprising deviations and exaggerations of reality abound (Neale & Krukin, 1990; Sobchack, 2004). Our transformation hypothesis predicts that moderate movement transformations from non-fiction scenes cue drama and action categorizations, while strong transformations cue comedy categorization.

2. Method

2.1. Materials

A Basic chase scene between two abstract blocks was animated and varied as to five movement parameters. A chase was selected as the animations’ action script, because the underlying intention is highly recognizable from a simple motion pattern (Barrett et al., 2005; Blythe et al., 1999). Animations produced in 3D MAYA 6.0 lasted 15 s each. Camera movement served action visibility, and was kept unobtrusive – see Fig. 1.

The choice of movement parameters was inspired by an analysis of 80 chase scenes from the films of various fiction and non-fiction genres (news, sport, documentaries, and animals), personal interviews with animators, and the literature. Selected movement parameters were velocity, efficiency, fluency, detail, and deformation, for each of which four versions were made deviating from the Basic scene in one or the other direction. Deviations could be moderate (+ or −) or strong (++ or −−). Differences between the deviations were exponential except for the efficiency parameter.

2.2. Velocity

Velocity refers to the speed of the two blocks moving over the track. All objects, blocks, floor, and camera were scaled, but the track was not. Thus, perceptual sizes of the blocks and the duration of the scenes remained constant over all versions, while perceptual velocity varied. The variation factor was 1.5 between each two adjacent levels.
Comedies, especially the slap-stick type, use extremely fast or slow movements. Velocity is a strong factor in drama and comedy recognition (Visch & Tan, 2007) and in emotion. Fast movements evoke joy, surprise and excitement, whereas slow movements evoke sadness, weakness, gentleness and sympathy (Hille, 2001; De Meijer, 1989; Michotte, 1963; Pollick, Paterson, Bruderlin, & Sanford, 2001; Scherer & Ellgring, 2007).

2.3. Efficiency

The ratio between the energy a character uses in pursuing a goal and the energy minimally needed to achieve it determines perceived efficiency. In our stimuli, efficiency relates to the directness of the chaser’s track. In a negative efficiency version, the chaser’s zigzag movements are wider than those of the chased – see Fig. 2.

The action genre displays highly efficient actions in order to impress viewers (Neale, 2000). Drama protagonists’ lack of resolution is reflected in less efficient movement. Animation theory stresses inefficient actions’ potential for comic effects (Thomas & Johnston, 1981).

2.4. Detail

Detail pertains to the temporal density of velocity changes. The number of velocity alterations of the chaser was manipulated through the number of “keys” in animation. (A “key” is a programmed change of velocity at a specific moment in time.) Detail level — has two keys set at the beginning and at the end, with the block moving at a single velocity. Level — has five keys, the Basic scene eight, detail + 14, and detail ++ 26 keys, giving rise to 25 velocity alterations. High alteration densities seem to be characteristic of the chaotic character of movements in reality as compared to the movements in fiction. Ashida, Lee, Allbeck, Sun, and Badler (2001) found that when artificial agents displayed small and chaotic movements, they were perceived as more natural than when showing less-detailed movements.

2.5. Fluency

Movement fluency was manipulated by varying the smoothness of velocity transitions. The smoothest transition (fluency ++ ) was achieved by using a horizontal tangent at each velocity change, i.e. keypoint, resulting in a gradual deceleration to an extremely short period of no movement, immediately followed by a gradual acceleration. At the next two levels, the tangents become steeper, until they are vertical at the fluency–level, resulting in no acceleration nor deceleration. Further velocity abruptness at this level (—) was achieved by inserting duplicate frames in between keys, resulting in movement arrests of 40 ms each. In the fluency — condition, six frames were inserted, resulting in a 240 ms. stop of the chaser just before the velocity change.

Abrupt movements seem to be characteristic for comedy (stop-and-go chases of Laurel and Hardy and Chuck Jones’ Roadrunner) but also for the action genre where the action hero moves like a robot (Neale, 2000). Fluent movements, in contrast, appear to be more so for drama. As regards expressive effects, Wallbott (1998) found that non-fluent body movements express anger, fear, and joy, while fluent ones express sadness, boredom, and happiness.

2.6. Deformation

Deformation refers to dynamic shape alterations of the chaser object when changing its course. The ratio of height to the width of the object was exponentially scaled by one-third per step, keeping depth, and volume constant. Wide objects, level ++ , cause large wedge-shaped deformation in negotiating a bend, see Fig. 3, whereas high and narrow objects, level —, are minimally deformed.
Deformation is akin to the animation technique of "squash and stretch" (Thomas & Johnston, 1981), yielding a funny impression of elasticity of cartoon bodies. This is also a trademark of comedy actors, from Buster Keaton to Jim Carrey. In contrast, action heroes seem to possess extremely controlled and rigid bodies that scare and impress.

2.7. Dependent measures and experimental design

There are 12 dependent variables grouped into four types: genre categorization (comedy, drama, action, and non-fiction), genre-related emotional responses (funny, sad, impressive, and scary), aesthetic emotional responses (fascination, aesthetic liking, and surprise) and animacy. All dependent variables were measured using five-point likert scales. Two data sets were obtained, animacy ratings ("animacy study") and the remaining measures ("main study").

The design consisted of five non-crossed independent variables, the movement parameters, each with five levels (-C0/C0, 0, +, and ++). Level 0, the Basic scene, was one and the same scene for all five parameters. Because of its anchor function, the Basic scene was presented and rated twice by each participant, the average being taken as the data. Thus, in all, the stimulus set consisted of 22 scenes. Presentation order of scenes was randomized. For the main study two orders were created, one the reverse of the other. In the animacy study, the 22 scenes were randomly presented to each participant.

2.8. Procedure and participants

Each scene was shown twice followed by the rating of the participants. The main study consisted of two rating sessions each with a different randomized order, one for genre categorization, and the other for the aesthetic and emotional responses. The animacy study consisted of one animacy rating session in which the stimuli were randomized. In all, each of the 22 scenes, including the dual Basic scene, was presented four times to the participants in the main study and two times to participants in the animacy study.

Fifty-two participants (19 male, 33 female, ages ranging from 18 to 31), students of industrial design and of arts, joined in the main study and were rewarded with a cinema ticket. They were tested in groups from six to ten. Stimuli were presented using a beamer and ratings collected through questionnaires. Twenty-two psychology students (11 male, 11 female, ages ranging from 17 to 29) participated in the animacy study and received course credits. In the animacy study, the stimuli were presented on 15.1 in. computer screen and ratings were taken on-line.
3. Results

3.1. Animacy ratings

Data of the animacy study (N = 22) were analyzed using repeated measures and showed no significant effect of gender. The analysis did show that all movement parameter–level interactions, except that for ‘detail’, had significant effects on animacy ratings: velocity (F = 4.81, p < .01); efficiency (F = 5.67, p < .001); fluency (F = 7.68, p < .001); and deformation (F = 3.90, p < .01). Fig. 4 presents the animacy ratings as a function of movement parameters and levels. Significant linear trends were obtained for velocity (F = 7.59, p < .02), fluency (F = 11.05, p < .01), and deformation (F = 15.39, p < .01). Increases in velocity and fluency resulted in higher animacy ratings and increases in deformation resulted in lower animacy ratings. Increases in the parameter efficiency from level 1 (−−−/C0/C0) to 4 (++) did not have a significant effect on animacy ratings, but level 5 (++) was rated as being significantly less animate than any of the former levels (F > 6.63, p < .018). The effect of efficiency on the animacy ratings was best described by a quadratic contrast (F = 10.57, p < .01).

3.2. Genre and emotion ratings

The data of the main experiment (N = 52) were subjected to MANOVA showing that control variables gender and order had no main effects on the dependent variables (F = 2.27, p = .13; F = 0.63, p = .43). Table 1 presents the optimal levels of the movement parameters for each of the 11 categorizations and responses plus the animacy ratings.

3.3. Correlations

Correlations between animacy-, emotion-, and genre-ratings were obtained by calculating Spearman rank correlations between the means of the dependent variable for each of the 25 level–movement parameter combinations. Animacy correlated strongly and positively with non-fiction categorization, validating our first animacy hypothesis: (r = .63). An additional significant correlation of animacy attribution was found with action categorization (r = .51). Animacy did not correlate significantly with emotion ratings.

The emotion hypothesis predicting correlations between distinct emotions and genres was tested using not
the means, but the individual ratings obtained in the main study. Significant correlations were found with the fiction genres only, for the pairs comedy genre and response “funny” ($r_s = .49$), drama and “sad” ($r_s = .24$), and action and “impressive” ($r_s = .33$). Non-fiction was not correlated with any emotion, including “scary” or “impressive”.

3.4. Genre classification

Fig. 5 presents the effects of movement transformation on genre categorizations. In order to test the realism prediction, the levels of all movement parameters were collapsed from five to three levels: 0, 1 (+ and −) or 2 (++) and −). Significance was established using post hoc Games Howell tests. Analysis showed that unmanipulated movement scenes were categorized significantly stronger as non-fiction than as any other genre. Moreover, they were categorized as non-fiction stronger than were manipulated movement scenes. Our third realism hypothesis was validated in that unmanipulated movement scenes were categorized strongest as non-fiction, second to strongest as drama, second to weakest as action, and weakest as comedy. The transformation prediction also received support. Moderate transformations of movements increased
classification in all three fiction genres significantly compared to untransformed movements. Strong transformations only significantly increased categorization in the comedy genre. It is noteworthy that categorization as the comedy genre was affected by movement transformation in exactly the opposite direction as non-fiction categorization ($r_s = -0.31$) – see Fig. 6.

4. Discussion

This study showed that the movements of abstract objects, varying on velocity, efficiency, detail, fluency, and deformation, elicit consistent higher-order categorizations of film scenes as to genre, as well as lower-order emotion responses and animacy attributions.

Animacy attributions increased, first, by a relatively high velocity of the object probably resulting in more ‘lively’ movements. Second, animacy was increased by the lack of deformation of the object when it negotiates a bend. This result is unexpected in light of the widespread occurrence of squash and stretch deformation in animated cartoons (cf. Thomas & Johnston, 1981). However, object deformation may have been confounded with object proportion: strong deformations featured horizontally oriented object shapes, not resembling living bodies, whereas weak deformations were paired with tall upright objects, resembling human body shapes, which contributes to animacy attribution (Lange & Lappe, 2006). Third, movement efficiency affected animacy. This could be expected since efficiency in a chase is closely tied to proposed animacy cues: (a) goal-directed movement (Blakemore et al., 2003; Opfer, 2002) and (b) intentional relations or interactivity between objects (Neri, Luu, & Levi, 2006; Schultz, Friston, O’Doherty, Wolpert, & Frith, 2005). However, we found a significant drop of animacy attribution when the chaser’s efficiency was extremely high. This effect may be due to seeming anticipatory capacities of the chaser enabling machinelike precision in predicting where the chased will end. Fourth, a similar effect of negative animacy attribution to machinelike movements was found with extremely low-fluent movements, which featured exclusively abrupt starts and stops. The lack of acceleration or deceleration also reminds one of machine behavior rather than the conduct of sentient beings. The prediction that animacy attribution is associated with film realism, involving animate action, is validated by the considerable correlation between animacy ratings and non-fiction categorization. We suggest that animacy attribution is not only functional for adaptive purposes like proper social interaction (Allison et al., 2000) and avoidances of dangerous species (Schultz, Friston, O’Doherty, Wolpert, & Frith, 2005), but it seems also to confer ‘reality status’ upon percepts of motion pictures.

Specific stimuli movements that were varied in this experiment induced specific emotional responses by the viewers such as low velocity generating sadness – in line with De Meijer (1989) and Pollick et al. (2001). Concerning the role of emotion in genre categorization, we found that each of the fiction genres correlated significantly with a specific emotion, according to expectation: comedy with funny, drama with sad, and action with impressive. As expected, non-fiction did not correlate with emotion ratings. The contrast between functions of fiction and non-fiction, one affective and the other informative, was already proclaimed by Aristotle (Trans., 1988).

As to the effects of movement transformations, untransformed movements seemed to give the viewer an impression of realism as they were categorized as an instance of the non-fiction genre, as the realism hypothesis predicted. Moreover, these realistic movements were categorized in declining order from non-fiction to drama to action to comedy, conforming to the transformation hypothesis. The degree of transformation from the unmanipulated ‘realistic’ movements determined as what particular fiction genre scenes were categorized: moderate deviations resulted in categorization as drama and action, large deviations as comedy.

The results have two implications for a cognitive theory of genre. Firstly, they suggest that genre knowledge consists in part of representations that can be evoked by the specific types of movement. Secondly, the results suggest that genres are not separate mental categories but organized as to their deviation from non-fiction. The knowledge involved may be expected to be implicit (Schacter, 1996): people might use it in classification without being able to explicitly describe the movements or their transformative distance from non-fiction movements. In line with theorizing by Mar and Oatley (2008) and Goldman (2006) we believe that the embodied simulation of character movement is inherent to typical responses to fiction. It can be expected that film viewers match their perceptions as a default with their large repertoire of non-fiction motor experiences (Barsalou, 2008). The extent of successfulness of such a match could function as an implicit cue for classification processes (Bielock, Lyons, Mattarella-Micke, Nusbaum, & Small, in press; Goldman & Sripada, 2005; Helbig, Graf, & Kiefer, 2006) of fiction. Future research, using online measurements such as brain imaging, might reveal whether matching with real life motor repertoires occurs in fiction processing. On-line measurements could also shed light on dependencies between genre categorization and attributions to movement percepts.

In summary, we have shown that naïve subjects are able to categorize genres, including fiction and non-fiction, consistently according to object movement parameters. Such a genre classification is achieved by, at least, three distinct cognitive processes: (a) animacy attribution, which influences the fiction versus non-fiction classification; (b) emotional responses, which influences the classification of a specific fiction genre; and (c) the amount of deviation from reality, at least with regard to movements.

Acknowledgements

We would like to express our gratitude to the journal editor Gerry Altman and three anonymous reviewers for their stimulating and helpful comments, which have greatly improved the quality of this manuscript.