Exploring facial expression recognition in human- and animal animated characters

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Abstract

To examine the differences in perceiving facial emotions from animal- and human animated characters a between-subject survey was conducted. Even though human and animal animated characters express the same emotions, differences are possible. This study, therefore, measures the differences between animated characters (animal versus human) on accuracy and duration of recognition for the following emotions: happiness, sadness, anger and fear. First, the results show that animated human emotions are more accurate than animated animal emotions. Second, the emotion 'anger' of animated human characters were perceived stronger than those from animated animal characters. Third, the emotion 'happiness' of animated animal characters is not perceived stronger compared to animated human characters. Fourth, emotions of animated human- and animal characters are recognized at the same speed. Finally, emotions with evident cues are recognized faster than those with less evident cues. The relevance of the findings of this study are mentioned in the discussion.

Keywords: facial emotions, animated characters, animal versus human, recognition, duration.

Introduction

Animation movies are getting more popular every year (List of animated feature films, 2018). Due to this popularity, the number of short animation videos online - mostly created by hobbyists - is increasing enormously. They are popular because of various reasons, for example: they deliver a message, they appeal to both adults and children and the animation can be funny and emotional. But how do we perceive animated emotions and is there a difference between animated facial expressions for human characters and animated facial expressions for animal characters? To answers these questions this research explores facial expression recognition in animations, focusing both on human characters and animal characters.

Emotions and their facial expressions

Research into emotions has a long history, especially done by Ekman (1992). He concluded that emotions exist so that humans can deal with experiences and confrontations between organisms (between people or in a situation with animals). In his studies Ekman (1992a, 1992b, 2007) mentions the existence of six 'basic' emotions: fear, anger, sadness, disgust, happiness and surprise. These 'basic' emotions are assumed to have natural fundamentals and unconditioned expressions (Izard, 1992). Other research by Ekman and Friesen (1975) concluded that the basic emotions are the overarching emotions which include sub-emotions that have the same characteristics. Furthermore, they mention that the characteristics that are shared within an overarching family of emotions are different than the characteristics of the other families of emotions.

Ekman (2007) found out that expressions are culturally universal, as was once theorized by Darwin (1873) in his book 'The expression of the emotions in man and animals'. This means that all cultures share and recognize the same emotional concepts with their corresponding facial behaviors (Ekman & Friesen, 1971). Nonetheless, according to Ekman (1992) the evidence for the basic emotions of surprise and anger is less steadfast. In his studies, the emotion surprise was clearly distinguished from anger, disgust, and happiness, while in non-literate cultures surprised expressions were not distinguished from fearful expressions. To conclude, some emotions are very similar, that is why this study will only focus on the four (basic) emotions that are clearly distinguished from each other: happiness, sadness, anger and fear.

Emotions are all expressed in a different way in the face. These facial expressions can be read and classified through FACS, the facial action coding system, developed by Ekman and Friesen (1978). This coding system matches certain emotions with the facial muscle activity seen in the corresponding facial expression. Table 1 shows an overview of the emotions this study looks at and the matching action units.

Table 1: Overview of emotions and their action units according to FACS (Ekman & Friesen, 1978).

Emotion	Action units	Visible muscle activity
Happiness	6, 12	Cheeks raised, lip corners pulled upwards.
Sadness	1, 4, 15	Inner brows raised, lowered / squinced in between the brows, lip corners downwards.
Anger	4, 5, 7, 23	Lowered / squinced in between the brow, upper eyelids raised, eyelids tightened (squinting the eyes), lips tightened.
Surprise	1, 2, 5, 26	Inner brow raised, outer brow raised, upper lip raised and jaw dropped.
Fear	1, 2, 4, 5, 7, 20, 26	Inner brow raised, outer brow raised, brow lowered, upper lid raised, eyelids tightened, lips stretched and jaw dropped.

Recognition of emotions

The six basic emotions can be read according to above-mentioned facial action coding scheme, but how about recognition of the emotions? A number of studies have highlighted that some facial expressions are for evolutionary reasons- universal, the question is raised if we also recognize and perceive these emotions the same way. From a psychological perspective, Barrett (2006) argues "that the way people learn about emotion categories and use of conceptual knowledge determines what they see and feel" (p. 37). In other words, the way someone conceptualizes an instance of emotion, because of individual difference in prior experience, will lead to variation in which emotion are experiences and how it is experiences (Barrett, 2006).

While there is a lot of research on human emotions, there is a relatively small body of literature that is concerned with recognizing and perceiving emotion from animals. Darwin provides us with the insight that the human mind has the capacity to see in the behavior of non-human entities or animals the same kinds of convert emotional states it sees in the behavior of other humans (Spunt, Ellsworth & Adolphs, 2016). Thus, humans cannot help but attribute human emotions to animals. This projection of our own attributes onto non-human entities is called anthropomorphism. Regarding video animations, using anthropomorphism animated techniques, animated figures, such as animals, receive human like characteristics, motivations, intentions, or emotions (Epley, Waytz, & Cacioppo, 2007). So, animated human characters show the same characteristics and emotions as animated animal characters. Based on this, the study examines the following hypothesis:

H1a. There is no difference between the accuracy of recognized emotions of human and animal animated characters.

Looking at the interaction between human and animals and the perceived emotions, the study by Vanutelli and Balconi (2015) is worth mentioning. They explored the empathic brain mechanisms for other peers in human-human and human-animal interactions during friendly, aggressive and neutral situations. A higher brain activity indicates a stronger (empathic) relation. In a nutshell, they concluded that there was more brain activity caused by aggressive human-human interactions than human-animal ones. However, they also found that regarding to human-animal interaction, friendly ones were related higher to brain activity. Based on the result of this study and our own interpretation we developed the following hypotheses:

H1b. The emotion 'anger' of animated human characters will be perceived stronger than the angry emotions of animated animal characters.

H1c. The emotion 'happiness' of animated animal characters will be perceived stronger than the happiness emotions of animated human characters.

Duration of recognizing of emotion

Multiple researchers have tackled the issue of which of the basic emotions are recognized the easiest, when the task is based solely on exposure to emotional facial expressions (EFEs). In this regard, an overwhelming amount of research has concluded that happiness and surprise are the EFEs that are recognized the quickest among participants (Calvo, Gutiérrez-García, Fernández-Martín & Nummenmaa, 2014; Tottenham, Tanaka, Leon, McCarry, Nurse & Hare, 2009), followed by sadness and anger, while fear is often the hardest to recognize (Calvo & Lundqvist, 2008; Kirouac & Dore, 1983).

Regarding happiness particularly, results could be justified by an effect researchers have dubbed the "happy face advantage". This effect suggests that the presence of a smile in facial expressions gives happiness an advantage when it comes to emotion recognition, because it is a very visually salient feature the human mind automatically links with the manifestation of the emotion (Kirita & Endo, 1995), perhaps even being the only necessity for its recognition (Leppänen & Hietanen, 2007). Moreover, research by Wingenbach, Ashwin and Brosnan (2016) concluded that EFEs of high intensity (such as happiness and anger) are easier to recognize than those of low intensity (such as fear and sadness), because these include a lesser number of evident cues that can be utilized by audiences to accurately identify the emotion. This reasoning might be able to explain why happiness is easy to identify and thus recognized the quickest; given the set of very evident cues. Following that same line of reasoning, conclusions by Wingenbach, Ashwin and Brosman (2016) could also help explain why fear is consistently the hardest emotion to identify, given that – except in circumstances where the emotion is extreme – the facial expression of fear is not only lacking on evident cues, but is also extremely variable across individuals when compared to other emotions. The emotions sadness and anger scored somewhat the same when looking at the response time.

Finally, regarding emotion recognition research has shown three things worth noting: (a) expressions occurring more frequently, are more accurately and are faster recognized, (b) response times are generally shorter for easy to recognize EFEs, such as happiness, than emotions with few EFEs. Thus, all aforementioned research allows us to hypothesize that:

H2a: Emotions of animated human characters will be recognized at the same speed rate as emotions of animated animal characters.

H2b: Emotional facial expressions with consistent evident cues (such as happiness) will be recognized faster than those with less evident cues (like fear).

Method

In order to test the hypotheses, a survey was conducted to measure the recognition of emotions of animated characters and how quickly they are recognized. The research question

was: "To what extent do we perceive animated animal emotions as more evident than animated human emotions?"

The participants were randomly assigned to a between-subject survey design. The independent variable was the animated characters (animal versus human) and the used emotions were anger, happiness, sadness and fear. The dependent variables we measured are: recognizing the emotion correctly and the duration of this recognition.

Participants

Exclusively Dutch participants were recruited in order to define the target group and to prevent possible cultural differences. A total of 111 Dutch participants opened the survey. However, as 20 participants did not complete the whole survey, these data were excluded. Thus, only the data of 91 participants were used. Of these remaining participants 59 were female and 32 were male. The average age of the female participants was 32.58 (SD = 13.88), and for male participants this was 38.31 (SD = 14.84). Of all participants, 44 participants saw the stimuli for the animal condition and 47 participants saw animated characters for the human condition. Additionally, before testing H2a and H2b the reaction times were analyzed regarding potential outliers based on that they were two times larger than the standard deviations, which we interpreted as not plausible reaction times. Four participants' values for reaction time were changed to missing values, these participants' reaction times ranged from 83.25 seconds to 4088.14 seconds.

Stimuli and procedure of coding

Each participant got to see 16 video clips from one out of two categories (animals- or human animated characters). The video clips were all retrieved from YouTube (www.youtube.com) and were edited, so that there was no sound and the image was zoomed in on the facial expression. Also, the video was shortened to approximately one second to show only the basic emotions, namely: angry, happy, sad, and fear. Each participant saw four video clips of each single emotion. The links to these video clips and their order can be found in Appendix 1.

There were different criteria for the video clips. First, the video clips should be animation videos and no drawing or real-life videos. Second, the short-animated video clips could not be famous or well-known, such as animation movies from Disney or Pixar, because people would have been able to know and remember the storyline and the emotions of the characters instead of recognizing the emotions. Third, the emotions of the animated characters should be clearly visible. Fourth, only the emotion of the characters should be visible and no other factors should distract from the emotion. The distracting factors were for example; background, sound, other characters and body language.

Additionally, there were different criteria for each emotion. These criteria were made clear in a complete overview in Appendix 2. This overview shows how the nonverbal movements of the eyebrows and the mouth are used to identify every single emotion. For the emotion happiness, the eyebrows need to be round and high, and the mouth corners should be pulled upwards. For the emotion anger the eyebrows should be lowered and squinced in between the eyebrow and the lips tight together. In the nonverbal movements for sadness the inner brows are raised and should be lowered and squinced in between, and the mouth corners are pulled down. Finally, with the emotion fear the eyebrows are high and round and the mouth is open and the corners are pulled down. An example is shown in figure 1 and 2 of the emotion sadness.

All of the 32 coded video clips were checked by four researchers based on the criteria. This was done to make sure that every single video clip showed the correct emotion as noted. If there was no agreement about the clarity of an emotion between the researchers, a new video clip was sought. Until every single video clip was perceived the same by the four researchers.

Figure 1: Sad animated animal.

Figure 2: Sad animated human.

Survey procedure

The survey was created in the web-based tool Qualtrics. The survey was written in Dutch, so the researchers shared the online link to the survey on their personal Facebook accounts with their Dutch friends. This way of sampling is called convenience sampling. The participants could voluntarily join the questionnaire.

The introduction at the beginning of the survey informed the participants about the topic of the research and that the data is dealt with confidentiality. Also, an explanation was given about how to participate in this survey; as it was designed for personal computer and laptop only.

The participants were equally and randomly assigned to one of the two conditions (animal or human animation). Each condition contained two demographic questions (gender and age) and sixteen video clips. Four of these sixteen video clips were examples, the remaining were the experimental video clips. The video clips had the emblem of the university as 'starting screen'. Therefore, participants could not get any idea of the content of the clip nor the emotion in that clip before pressing on the play button. By clicking the play button, the timer, which measured how fast someone answered, was turned on.

Before each video clip, participants were kindly asked to first watch the clip with great accuracy and then identify which facial emotion occurred in the clip. The choice of emotion could be given by choosing one out of four given emotion buttons (happy, angry, sadness, and fear) that were

visible below the clip. For measuring the emotion response time in seconds, a hidden timer was added to this question. The timer recorded the moment from pressing the play button (first click), the moment from indicating the choice of emotion (last click) and the moment that a participant pressed the next page button (page submit. Next to this, all button clicks (click counts) on possible buttons (play, replay, and choice of emotion) were recorded. In the next question, participants were asked to indicate the level of emotion they just recognized in the video clip. The level of emotion was measured on a 7-point scale (from very weak to very strong).

After showing five clips out of twelve experimental stimuli, participants were asked to take a short break to secure the quality of focus in watching the clips and emotions. The second part of the survey could be started by pressing the next button shown on the bottom of the 'short break' slide.

At the end of the survey, participants could give their email addresses for receiving the research paper and had also the opportunity to give feedback or comments on the survey. The whole survey can be found in Appendix 3.

Results

H1a

To test whether participants in the human condition and participants in the animal condition identify emotions with similar accuracy levels, we performed an independent samples t-test. There was significant skewness or kurtosis in both conditions (human condition: $z_{skewness}$= -0.80, $z_{kurtosis}$= -1.42; animal condition: $z_{skewness}$= -1.83, $z_{kurtosis}$= 4.79). Therefore, the p-value may not be reliable and more weight should be placed on the bootstrapped 95% confidence interval that will be provided. Moreover, Levene's test resulted in a significant value (p = .003), and therefore equality of variances is not assumed. On average, participants in the human condition (M = 0.97, SD = 0.04) reported higher accuracy scores than participants in the animal condition (M = 0.95, SD = 0.07). This difference was significant, $Mdif$ = 0.02, $t(89)$ = 2.07, p = .049, BCa 95% CI [0.001, 0.051]. These results disprove hypothesis H1a, suggesting that there is in fact a difference in accuracy levels when recognizing emotions between animated human characters and animated animal characters.

H1b and H1c

In order to determine whether aggressive emotions – such as anger – result in higher perceived intensity in human-human interactions; and similarly, if friendly emotions – such as happiness – trigger high perceived intensity in human-animal interactions, a one-way repeated measures ANOVA was conducted. The assumption of normality was supported for the standardized residuals of aggressive emotions ($z_{skewness}$= -0.34, $z_{kurtosis}$= 0.02) as it was for the standardized residuals of friendly emotions ($z_{skewness}$= -0.26, $z_{kurtosis}$= 0.09). The assumption of homogeneity of variances was met (p_{anger}= .21, $p_{happiness}$= .06); and given that the design was comprised of just two levels, violation of sphericity assumptions does not apply to this case.

Results for the within-subjects factor of the ANOVA show that there was no significant difference in perceived intensity levels across the type of emotion (aggressive vs. friendly) variable, $F(1, 90) = 1.33$, p = .251. However, results for the between subjects factor of the ANOVA show that there was a significant effect for condition (animal vs. human) in perceived intensity levels, $F(1, 90) = 38.84$, p = .001. Furthermore, no significant interaction effect between type of emotion and condition was found. These results allow us to conclude that even though there were significant differences in how participants perceived the intensity of aggressive emotions across conditions and also in the perceived intensity of friendly emotions across conditions (see Table 2 in Appendix 5 for pertinent measures); these differences are due to the effect of the condition variable (human character vs. animal character), and not to that of the type of emotion. This is further supported by the fact that hypothesis H1b was supported but hypothesis H1c was not. If the type of emotion (aggressive versus friendly) were to have a significant effect across conditions, both hypothesis would have been supported by the data. This relationship is shown graphically in Appendix 4.

H2a

To test the hypothesis that emotions of animated human characters will be recognized at the same speed rate as emotions of animated animal characters, a one-way ANOVA was performed. The assumption of normality was violated for both conditions (human condition: $z_{skewness}$ = 4.30, $z_{kurtosis}$ = 2.31; animal condition: $z_{skewness}$ = 3.59, $z_{kurtosis}$ = 2.48). The assumption of homogeneity was met. As the ANOVA is fairly robust against violations of normality the ANOVA was done without bootstrapping. The ANOVA did not show a significant effect of the condition human animated facial expressions of animal animated expressions, $F(1, 89) = 2.53$, p = .115. On average, participants that saw the animal condition were only slightly quicker in reaction time (M = 8.51, SD = 3.11), compared to the participants in the human condition (M = 9.71, SD = 3.97). As the hypothesis expected that there would be no difference, H2a can be accepted.

H2b

To test whether emotional facial expressions with consistent evident cues (happiness and anger) will be recognized faster than those with less evident cues (fear and sadness), a one-way repeated measures ANOVA was performed. The assumption of normality was not supported for both standard residuals of high evident facial expressions ($z_{skewness}$ = 5.22, $z_{kurtosis}$ = 2.72) and low evident ($z_{skewness}$ = 6.65, $z_{kurtosis}$= 5.44). However, as the ANOVA is fairly robust against violations of normality, the ANOVA was done without bootstrapping. The assumption of homogeneity of variances was met, $F_{\max}$ was 1.33; as there were only two levels for the within-subjects design, sphericity could not be a complication. The ANOVA results show that there was a significant difference in reaction time for high evident and low evident emotions, $F(1, 90) = 8.87$, p = .004, partial η^2 = .09. This can be seen as

a small to medium sized effect. Participants were 0.7 seconds faster in recognizing high evident expressions (M = 8.78, SD = 3.50), compared to low evident expressions (M = 9.48, SD = 4.04). Thus, the hypothesis that emotional facial expressions with consistent evident are recognized faster than those with less evident cues, can be accepted.

Additionally, the repeated measures ANOVA showed an interaction effect between animation condition (human versus animal) and evident level of the cues (high versus low) on reaction time. A significant interaction effect was found, $F(1, 89) = 9.50$, $p = .003$. For participants in the human condition there was a higher difference in reaction times between low evident emotions (M = 10.40, SD = 4.45) and high evident emotions, which were recognized 1.37 seconds faster (M = 9.03, SD = 3.88), than for participants in the animal condition. While the difference between high evident (M = 8.52, SD = 3.07) and low evident emotions (M = 8.50, SD = 3.34) in the animal conditions was only 0.02 seconds. Table 3, which can be found in Appendix 6, shows an overview of the means and standard deviation per condition in the interaction.

Discussion

The aim of this study was to examine the differences in perceiving facial emotions from two types of animated figures, human versus animal. First, animated human emotions are reported more accurate than those from animal animations. Second, the emotion 'anger' of animated human characters was perceived stronger than those from animal animations, as also happened with the emotion 'happiness'. Fourth, emotions of animated human- and animal characters are recognized at the same speed. Finally, emotional facial expressions with consistent evident cues are recognized faster than those with less evident cues. Below we further elaborate on these findings.

We expected that there were no differences in accuracy of recognizing emotions between the two conditions (H1a) based on the fact that video animations use anthropomorphism animated techniques (Epley, Waytz, & Cacioppo, 2007). The results, however, showed the opposite. Animated human emotions were reported as more accurate than animated animal emotions. This could suggest that we as human people are more familiar with human faces, and the emotions shown on both animated character are well known as real human emotions. However, this is still a speculation, future research is needed to explore this theory.

Another finding of this study is that the emotion 'anger' of animated human characters were perceived stronger than the angry emotions of the animated animal characters (H1b). This is in line with Vanutelli and Balconi (2015). However, hypothesis H1c states that the emotion 'happiness' of animated animal characters will be perceived stronger than the happiness emotions of animated human characters, is not confirmed by the results, and therefore not in line with Vanutelli and Balconi (2015). A possible explanation, for the fact that no difference has been found for happy emotions between the conditions, might be the frequency of emotions, perhaps happiness is an emotion that is expressed more often.

When looking at the duration of recognizing emotions, the results of this study show that emotions of animated human characters are indeed recognized at the same speed as emotions of animated animal characters. This result confirms hypothesis 2a and are in line with the results from Calvo et al. (2014), Tottenham et al. (2009), Calvo & Lundqvist (2008), and Kirouac and Dore (1983). Also, the results of hypothesis 2b can be confirmed. Emotional facial expressions with consistent evident cues (such as happiness) are indeed recognized faster than those with less evident cues (like fear). H2b is therefore in accordance with the results from Kirita and Endo (1995), Leppänen and Hietanen (2007), and Wingenbach, Ashwin, and Brosnan (2016).

Limitations and future research

Like all studies, this study has its limitations and therefore tips for future research. With our results, we could probably point to a trend, but future research is needed to ratify these results. First, future research can incorporate all six basic emotions instead of the four emotions in the current study. With this, more knowledge about recognizing face expressions on animated figures can be achieved and can possibly answer the question why animated human emotions are more accurate recognized by people than animated animal emotions. Second, the design of the study can be changed to a 2 x 2 design. With this not only the type of animated character is examined, but also the evident level of the cues. Third, in this study the reaction time was measured in seconds. Generally, reaction time studies point to a deeper cognitive level and measure the reaction time in milliseconds. With our (online) survey in Qualtrics we were not able to do this. Fourth, in further research it is advisable to arrange the conditions around the participant, so that outside distractions can be shutout, for example with the use of a soundproof cabin. The disadvantage of this is that people have to make more effort to participate in the research. Finally, the current study contained only Dutch participants, which means we got the data only from one cultural and language group. Perhaps sending out an English survey as well, would give more global data and more cultural mixed findings.

As stated before, the aim of this study was to examine the differences in perceiving facial emotions from two types of animated figures, human versus animal. In this study, results from earlier studies were ratified. However, this study also showed that previous findings were not in line with recent findings. First of all, there is a difference between the accuracy of recognized emotions of human and animal animated characters. Next to that, this study found that the emotion 'happiness' will be perceived equal in animated human characters and animated animal characters. Therefore, this study contributes to further research in perceiving facial emotions on animated figures.

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Appendix

Appendix 1 – Links to video clips

Short animation videos - condition human

Clip code survey	YouTube	Emotion	URL	Play time
VBCH1	CH 01	Happy	https://youtu.be/AVfqqNM1Z7A	1.2 seconds
VBCH2	CH 14	Angry	https://youtu.be/Y3TF9J6Dw28	1.2 seconds
VBCH3	CH 02	Sad	https://youtu.be/TNPzJhXjDaE	1.5 seconds
VBCH4	CH 15	Fear	https://youtu.be/4liDTLzN6Qo	1.4 seconds
1CH	CH 03	Fear	https://youtu.be/hCi3WWKVh84	1.2 seconds
2CH	CH 11	Angry	https://youtu.be/tbzL33VXnj8	1.3 seconds
3CH	CH 05	Happy	https://youtu.be/Hqd5Mqd_ybI	1.0 seconds
4CH	CH 13	Sad	https://youtu.be/opQZaHSNwpU	1.3 seconds
5CH	CH 10	Happy	https://youtu.be/DLhxgDzZQao	1.1 seconds
6CH	CH 07	Angry	https://youtu.be/44hxxjqTeM4	1.3 seconds
7CH	CH 04	Sad	https://youtu.be/Ubo9osF3VHs	1.0 seconds
8CH	CH 16	Fear	https://youtu.be/m0NYKnItXQc	1.5 seconds
9CH	CH 08	Happy	https://youtu.be/Qf04dtVs48c	1.3 seconds
10CH	CH 06	Sad	https://youtu.be/he--OiYpADg	1.4 seconds
11CH	CH 09	Fear	https://youtu.be/1IodjeB9Dhw	1.7 seconds
12CH	CH 12	Angry	https://youtu.be/50bOXN3e1xc	1.3 seconds

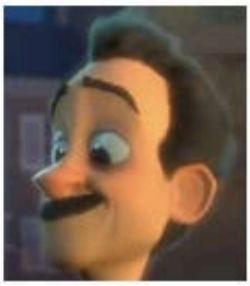
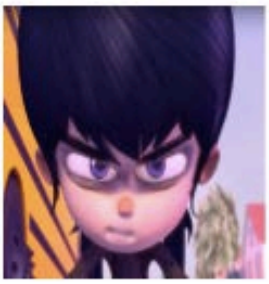
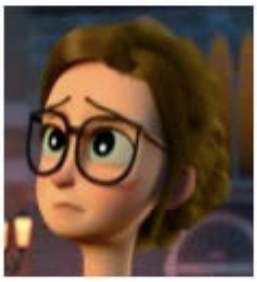
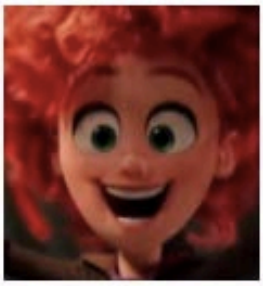
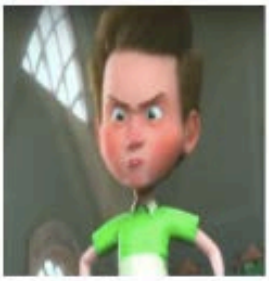
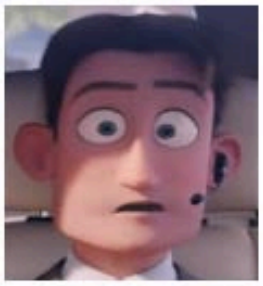
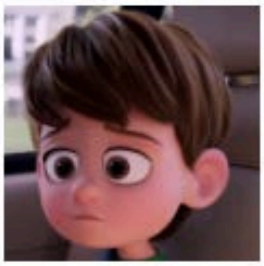
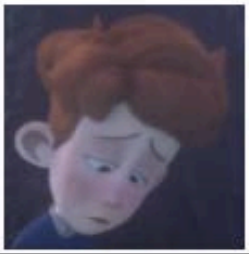
Short animation videos - condition animal

Clip code survey	YouTube	Emotion	URL	Play time
VB1CA	CA 09	Happy	https://youtu.be/a0gcf7uYK3U	1.3 seconds
VB2CA	CA 05	Angry	https://youtu.be/p006gs3kSoo	1.4 seconds
VB3CA	CA 08	Sad	https://youtu.be/OyQTdhWGB_g	1.1 seconds
VB4CA	CA 16	Fear	https://youtu.be/oqDcEB1ZODs	1.5 seconds
1CA	CA 01	Fear	https://youtu.be/QXZaey2dNdQ	1.4 seconds
2CA	CA 10	Angry	https://youtu.be/bHMeXwdNX6A	1.4 seconds
3CA	CA 14	Happy	https://youtu.be/BbW5Vt4bBFg	1.5 seconds
4CA	CA 02	Sad	https://youtu.be/9pvMZj9UYjg	1.7 seconds
5CA	CA 03	Happy	https://youtu.be/AeMjaO5V9mY	1.5 seconds
6CA	CA 15	Angry	https://youtu.be/1vRHSf42wkM	1.4 seconds
7CA	CA 04	Sad	https://youtu.be/5V3Mhq9SQdY	1.3 seconds
8CA	CA 06	Fear	https://youtu.be/y4ZYPdeyzRY	1.5 seconds
9CA	CA 12	Happy	https://youtu.be/-Gw3LHqW48I	1.3 seconds
10CA	CA 13	Sad	https://youtu.be/XwgMGIeyafc	1.6 seconds
11CA	CA 07	Fear	https://youtu.be/u7hpu76_A1U	1.1 seconds
12CA	CA 11	Angry	https://youtu.be/C1HUbTXvXF8	1.0 seconds

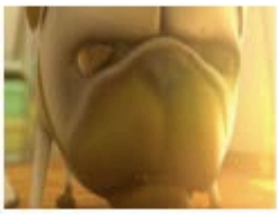
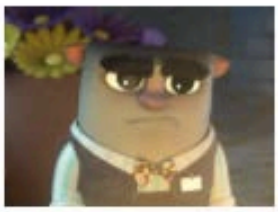
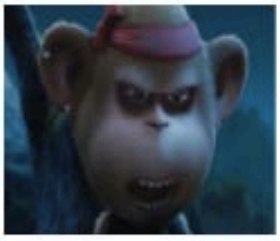
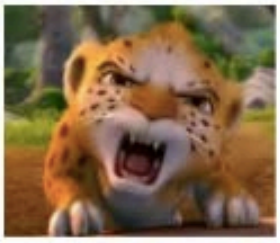
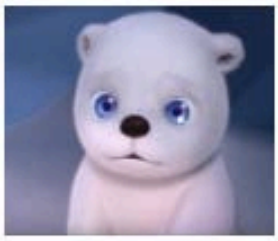
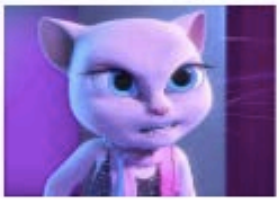
Appendix 2 – Criteria stimuli

Happy	Angry	Sad	Fear
			
Eyebrows: Middle/high and in a bow	**Eyebrows:** Lowered / squinced in between the brow	**Eyebrows:** Inner brows raised, lowered / squinced in between the brows	**Eyebrows:** High and round
Mouth: Cheeks raised, lip corners pulled upwards.	**Mouth:** Lips tight together Or mouth open and showing teeth	**Mouth:** Mouth corners are looking down	**Mouth:** Open and round Sometimes corners of the mouth downwards

Chosen stimuli for emotions animated human characters

Happy	Angry	Sad	Fear
			
			
			
			

Chosen stimuli for emotions animated animal characters

Happy	Angry	Sad	Fear
			
			
			
			

Appendix 3 – The whole survey

The whole survey - screenshot introduction

Welkom in ons onderzoek Non-Verbale Communicatie!

Beste respondent,

Allereerst willen we je bedanken voor jouw deelname aan ons onderzoek. Jouw bijdrage is essentieel in het beantwoorden van onze onderzoeksvraag. Wij waarderen de tijd die je in ons investeert dan ook enorm. De gemiddelde tijd om deel te nemen aan ons onderzoek is zeven minuten. We vragen je deze enquête in te vullen met jouw personal computer of laptop.

Daarnaast een uitleg hoe deel te nemen aan dit onderzoek:

In de volgende 'slides' worden 12 korte clips vertoond waarin animatie figuren bepaalde emoties in het gezicht vertonen. Iedere clip kent één gezichtsemotie. Jouw taak is om de emotie te benoemen die je herkent in de clip. Je kunt kiezen uit één van de vier emoties: vreugde, verdriet, angst en woede.

Na iedere clip geef je daarbij aan hoe sterk jij de gezichtsemotie in de clip vond.

Om te oefenen volgen eerst vier voorbeeldclips. Na deze vier voorbeeldclips start je met de twaalf clips. Volg gewoon jouw instinct bij het herkennen van de emotie die je in de clip ziet.
Veel kijkplezier!

Met vriendelijke groeten,

Denise van Breemen, Dennis de Clerck, Imke Goudsmits,
Soraya van Nieuwaal, José Rodriguez, Saranda Walgaard.

The whole survey - screenshot demographic questions

Twee algemene vragen:

Ben je een vrouw of een man?

Vrouw

Man

Wat is je leeftijd (in jaren)?

→

The whole survey - screenshot bridge to examples

Dit waren de algemene vragen. Na deze 'slide' start je met de vier voorbeeldclips.

Zoals in de introductie al aangegeven: volg je instinct bij het herkennen van de emotie.

The whole survey - screenshot example with start screen

TILBURG UNIVERSITY

Voorbeeldclip 1

1. Concentreer je op de animatie figuur in de clip
2. Druk op de 'start' knop om de clip af te spelen
3. Benoem zo snel mogelijk als je kunt de emotie die je herkent.

Ik herkende in de clip de volgende emotie:

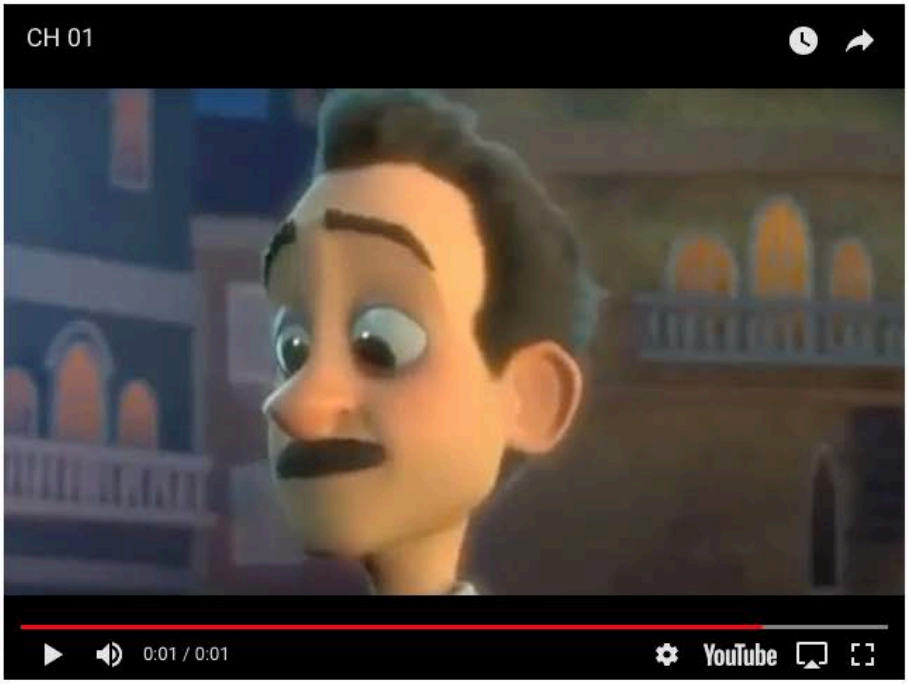
- Vreugde
- Verdriet
- Angst
- Woede

The whole survey - screenshot example with visible clip emotion after start

TILBURG UNIVERSITY

Voorbeeldclip 1

1. Concentreer je op de animatie figuur in de clip
2. Druk op de 'start' knop om de clip af te spelen
3. Benoem zo snel mogelijk als je kunt de emotie die je herkent.



Ik herkende in de clip de volgende emotie:

- Vreugde
- Verdriet
- Angst
- Woede

The whole survey - screenshot level of emotion

Ik vond de getoonde gezichtsemotie in de clip

Zeer zwak ○ ○ ○ ○ ○ ○ ○ Zeer sterk

→

The whole survey - screenshot bridge to the emotion clips

Dit waren de vier voorbeeldclips!

Wij hopen dat je een goede induk hebt verkregen van de manier waarop de gezichtsemotie wordt getoond én de wijze waarop je jouw herkende gezichtemotie kunt aangeven.

Na deze 'slide' start het experiment.

Nogmaals veel plezier én succes met de komende twaalf clips!

The whole survey - screenshot emotion clips with start screen

1. Concentreer je op de animatie figuur in de clip
2. Druk op de 'start' knop om de clip af te spelen
3. Benoem zo snel mogelijk als je kunt de emotie die je herkent.

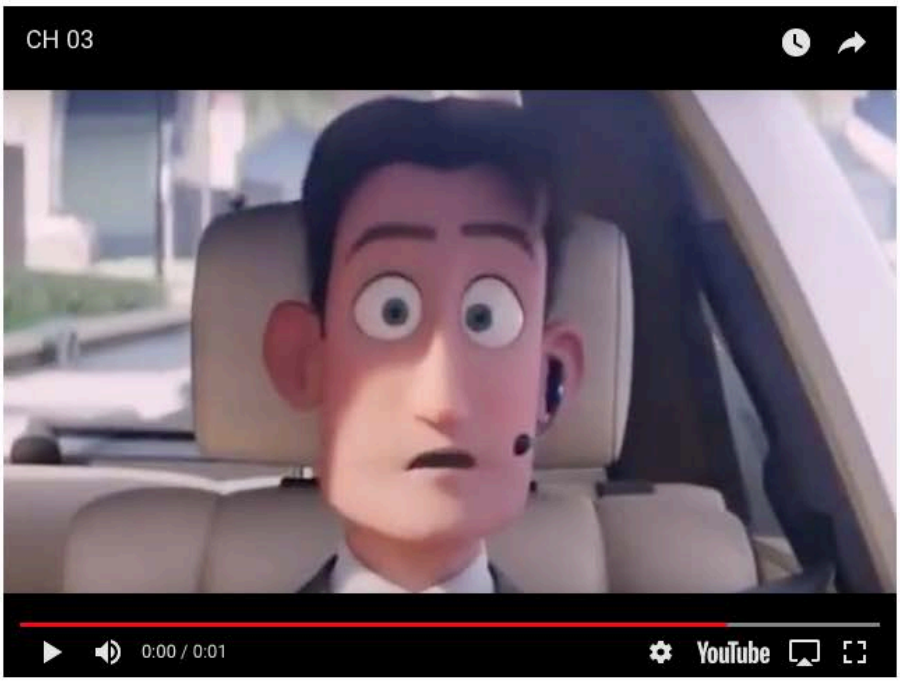
Ik herkende in de clip de volgende emotie:

- Vreugde
- Verdriet
- Angst
- Woede

The whole survey - screenshot emotion clips with visible emotion after play

TILBURG UNIVERSITY

1. Concentreer je op de animatie figuur in de clip
2. Druk op de 'start' knop om de clip af te spelen
3. Benoem zo snel mogelijk als je kunt de emotie die je herkent.



Ik herkende in de clip de volgende emotie:

- Vreugde
- Verdriet
- Angst
- Woede

The whole survey - screenshot level of emotion

Ik vond de getoonde gezichtsemotie in de clip

Zeer zwak ○ ○ ○ ○ ○ ○ ○ Zeer sterk

→

The whole survey – screenshot break between 5th and 6th clip

Als je behoefte hebt in een korte pauze kun je deze nu even nemen. Goed gefocust blijven is een vereiste om de clips te kunnen beoordelen.

Druk op de knop '->' om verder te gaan met het experiment.

The whole survey - screenshot feedback and comment end of survey

Je bent aan het einde gekomen van het experiment. Nogmaals onze dank voor je deelname!

Mocht je geïnteresseerd zijn in het resultaat van ons onderzoek, vul hieronder dan jouw e-mailadres in.

Heb je nog opmerkingen of feedback naar aanleiding van deze enquête? Laat het ons dan hieronder weten.

Appendix 4 – Figure relationship between type of emotion and type of animated character

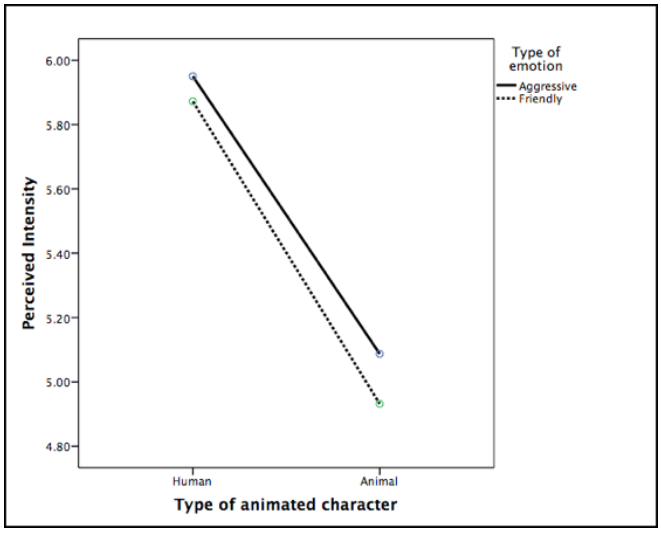


Figure 3: Perceived intensity scores for aggressive and friendly emotions across each condition.

Appendix 5 – Mean perceived intensity for all groups

Table 2: Descriptive statistics for all groups.

	N	Mean perceived intensity	Std. Deviation
Aggressive emotion for humans	47	5.95	0.78
Aggressive emotion for animals	44	5.09	0.99
Friendly emotion for humans	47	5.87	0.70
Friendly emotion for animals	44	4.93	0.89
Total aggressive emotion	91	5.53	0.98
Total friendly emotion	91	5.41	0.92
Total human condition	47	5.91	0.73
Total animal condition	44	5.01	0.94

Appendix 6 – Overview means and standard deviation per condition in the interaction

Table 3: Overview of the means and standard deviation per condition in the interaction.

Between-subjects condition	Within-subjects condition	Mean reaction time*	Std. deviation
Human	Low evident emotions	10.40	4.45
	High evident emotions	9.02	3.88
Animal	Low evident emotions	8.50	3.34
	High evident emotions	8.52	3.07

*Note: *Mean reaction time in seconds*