

PONTÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL
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MESTRADO EM PSICOLOGIA

**PROCESSAMENTO DE EXPRESSÕES FACIAIS DE JOVENS:
CONSTRUÇÃO DE UM BANCO DE IMAGENS E INVESTIGAÇÃO
DOS EFEITOS MODERADORES**

BRUNO MARTINS NOVELLO

Dissertação apresentada ao Programa de Pós-Graduação em Psicologia da Pontifícia Universidade Católica do Rio Grande do Sul como requisito parcial para a obtenção do grau de Mestre em Psicologia.

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RESUMO

Por considerar a importância do papel que as expressões faciais desempenham em relações interpessoais, esforços têm sido realizados para estudar o tema. Entretanto, ainda existem lacunas referentes a pesquisas com o público adolescente. Como esta etapa do ciclo vital é um período no qual relações interpessoais passam a ter destaque estando relacionadas a uma melhor qualidade de vida, esta dissertação teve o objetivo de suprir algumas destas lacunas. Para tanto, foram conduzidos dois estudos. O Estudo I objetivou preencher a lacuna referente à ausência de um banco de imagens que contenha estímulos faciais que representem as seis expressões básicas, englobando todo o período da adolescência e sua transição para o início da vida adulta. Para tal, foram coletadas expressões posadas e espontâneas de 31 jovens de 12 a 20 anos (14 homens, $M_{idade} = 17,4$, $DP = 2,7$). Três estratégias foram usadas: cenários mentais, expressões posadas e reações a estímulos visuais. Foram captados 2279 *frames* que após passarem por processos de filtragem do pesquisador foram avaliados por três juízes *experts* e reduzidos a um total de 42 *frames* (três para cada emoção básica e três para faces neutras, igualmente divididos entre os gêneros). Estas imagens foram padronizadas e, após terem passado por mais um painel de quatro juízes, foram validadas constituindo assim o *Youth Emotion Picture Set* (YEPS). Dado que existe uma carência de estudos que investiguem diretamente a relevância de covariáveis no reconhecimento de expressões faciais, o Estudo II teve como objetivo investigar o papel do QI verbal, do desenvolvimento púbere e da socialização poderiam ter na acurácia do reconhecimento de expressões em adolescentes. Participaram do estudo 90 adolescentes e jovens adultos (44 do sexo masculino, $M_{idade} = 16,7$, $DP = 2,4$) divididos em quatro grupos etários: 12-14 ($n = 23$), 15-16 ($n = 19$), 17-18 ($n = 24$) e 19-20 anos ($n = 25$). Eles tiveram seu QI verbal, quantidade de amigos, frequência de interações semanais com amigos e o nível de desenvolvimento púbere avaliados e realizaram uma tarefa experimental na qual deveriam categorizar a emoção apresentada nas imagens do YEPS em três velocidades (200ms, 500ms, 1000ms). Os resultados indicaram que a quantidade de interações sociais por semana com amigos está inversamente relacionada à acurácia no reconhecimento de expressões de raiva e nojo. O QI verbal foi significativamente proporcional a acurácia da identificação de expressões de surpresa, nojo e raiva. O desenvolvimento púbere se relacionou ao reconhecimento de expressões de alegria. A partir desta dissertação, foi possível desenvolver o YEPS, um instrumento que pode ser utilizado em outras pesquisas ou em estudos de aplicação clínica. Em relação ao Estudo II, foi possível identificar o modo como diferentes covariáveis operam no reconhecimento de expressões e que, entre as covariáveis estudadas, não existiu uma que fosse capaz de influenciar a acurácia de todas as emoções.

Palavras-Chaves: Emoção, Expressões Faciais, Adolescentes.

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ABSTRACT

Considering the role that facial expressions play in interpersonal relations, efforts have been made in order to better understand this topic. However, there are still gaps concerning research with adolescents. As this developmental stage is marked by interpersonal relations, and as these are related to a better quality of life, this dissertation aimed to fulfill some of the gaps in the topic. Two studies were conducted. Study I aimed to fill the gap concerning the absence of an image database containing facial stimuli representing the six basic emotion expressions encompassing the entire period of adolescence and its transition to the beginning of adulthood. To this end, posed and spontaneous expressions of 31 teenagers and young adult from 12-20 years (14 men, $M_{\text{age}} = 17.4$, $SD = 2.7$) were collected with the use of three strategies: emotive scenarios, posed expressions, and reactions to visual stimuli. Two thousand two hundred and seventy nine frames were captured. Expert judges ($N = 3$) filtered the frames, thus leading to a total of 42 final frames (three for each basic emotion, and three depicting neutral faces, equally divided between genders). These images were standardized and after passing through a new panel of expert judges ($N = 4$), they have been validated, thus composing the Youth Emotion Picture Set (YEPS). Since there is a lack of studies that directly investigate the role of covariates in recognizing expressions, Study II aimed to investigate the role the verbal IQ, pubertal development, and socialization in the accuracy of recognition of expressions among adolescents. Participants were 90 adolescents and young adults (44 males, $M_{\text{age}} = 16.7$, $SD = 2.4$) divided into four age groups: 12-14 ($n = 23$), 15-16 ($n = 19$), 17-18 ($n = 24$), and 19-20 years ($n = 25$). They were assessed with regard to verbal IQ, number of friends, weekly interactions with friends, and level of pubertal development. After that, they completed an experimental task in which they had to categorize the emotion displayed in three different presentation speeds (200ms, 500ms, 1000ms). The facial stimuli used were collected from the YEPS. Findings showed that number of interactions with friends per week was inversely related to accuracy in recognizing anger and disgust. Verbal IQ was significantly proportional to the accuracy of surprise, disgust, and anger. Pubertal development was related to the recognition of expressions of happiness. This dissertation resulted in the development of the YEPS, an instrument that can be used in studies exploring emotions in adolescents or for clinical application purposes. Study II revealed that different covariates influenced the recognition of emotion expressions. The covariates predicted differently accuracy in emotion recognition, with none of them explaining it for all emotions under investigation.

Key-words: Emotion, Facial expressions, Teenagers.

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Chapter 1: Introduction

Facial expressions have been studied in North America, Europe and Asia. Previous studies have focused on tasks related to recognition of expressions, development of image sets (Goevelen, Raed, Leyman & Verschuere, 2008; Langner, Dotsch, Bijlstra & Wigboldus, 2010), neuroimaging (Ganel; Valyear; Goshen-Gottstein; Goodale, 2005), specific disorders such as Social Phobia (Simonian, Beidel, Turner, Berkes & Long, 2001) or mood and anxiety disorders (McClure; Pope; Hoberman; Pine & Leibenluft, 2003), and on the development of software for automatic expression recognition (Littlewort et al 2011). The current study was developed following previous studies about the development and validation of image sets conducted by GNAT (Grupo de Pesquisa de Neurociência Afetiva e Transgeracionalidade) (Romani, Vieira, Mottin, Hertzog & Arteché, 2015). For the second study developed, institutional partnerships were made with six schools from the city of Passo Fundo: Escola Estadual Protásio Alves, Colégio Gama, Colégio Tiradentes, Escola Municipal Monteiro Lobato, Escola Estadual Fagundes dos Reis, and Escola Municipal Eulina Braga, in order to make data collection possible in these schools. The documentation needed for submission of this dissertation is annexed on appendices 1,2 and 3.

Research on facial expressions enable an expansion in the understanding of how the ability to recognize emotions in nonverbal ways develops (Calder et al., 2003; Herba & Phillips, 2004; Suzuki, Hoshino, Shigemasu, & Kawamura, 2006), contributes to the development of new technologies such as software development for automatic expressions recognition (Littlewort et al., 2011), has the potential to establish a new method for diagnosing psychopathy through experimental tasks (Wilson, Juodis, & Porter, 2011; Marsh & Blair, 2008), and could even help in the treatment of psychopathologies through training in emotion recognition (Wölver, Frommann, Halfmann, Piaszek, Streit, & Gabel, 2005). A range of applications can be derived from these studies on emotion recognition (e.g.,). Therefore the topic is considered of utmost importance with potential to contribute to cognitive, developmental and clinical psychology, and computer science.

The scientific interest in the face can be traced to ancient Greece, where there are records of rudimentary study of physiognomy made by Aristotle (Fridlun, 1994). At that time the facial expressions were not seen as a suitable object of study because of its short duration (Fridlun, 1994). Only in 1872 when Charles Darwin published "The expression of emotions in

man and animals" that they came to be seen as capable of being studied. Contrary to the arguments propagated by Bell who stated that facial expressions were a gift of god for the human beings, allowing the expression of passions (Bell 1806), Darwin argued facial expressions were not an exclusive system of emotional responses of the human race, but rather a non-verbal form of communication of emotional states present in different species (Darwin, 1872).

The second great pioneer in the study of emotion expressions is Paul Ekman, who from a study conducted in different parts of the world proved that expressions of six emotions characterized as "basic" (Disgust, Anger, Happiness, Fear, Sadness and Surprise) are universal (Ekman, 1969). Derived from his studies a few image databases of emotional expressions were developed such as the Facial Action Coding System (FACS), an atlas used to identify the movements of specific facial muscles involved in facial expressions (Cohn & Ekman, 2005), the Micro Expression Training Tool (METT) and the Subtle Expression Training Tool (SETT) (Ekman, 2003). The importance of Ekman to the field is such that the basic emotions studied by the author eventually became the standard in studies on the subject (Wagner, 1998).

Current research on the subject expanded the field and established dialogue with other areas such as computer sciences, clinical psychology and neurology. Thus, in addition to the development of software used to analyze expressions (Ali, Powers, Leibbrandt, & Lewis, 2011), the recognition of expressions began to be studied in different contexts: in cases involving adversity and mistreatment (Pollak, Cicchetti, & Hornung, 2000; Pollak & Sinha, 2002); related to specific biases such as own age bias (Ebner & Johnson, 2009); in the presence of psychopathology (Brown & Cohen, 2010; Hunter, Buckner, & Schmidt, 2009), associated with neuroimaging studies (Leppänen, Moulson, Vogel-Farley, & Nelson 2007; Sergerie, Chochol, & Armony, 2008), and in the human development, comprising studies evaluating the development of the recognition of expressions in different stages of the life cycle (Herba & Phillips, 2004).

The display of facial expressions in childhood are initially directly associated with the emotion being felt (Izard & Malatesta, 1987). With the growing up process, there is an increase in the amount of non-verbal communication performed intentionally (Barrett, 1993), thus the non-verbal communications start to become increasingly complex. As there are significant changes in the response time required to identify emotions during puberty as the reaction time of pubescents gets slower (McGivern, Andersen, Byrd, Mutter, & Reilly, 2002), and this is a period accompanied by changes in the brain caused by hormonal levels (Scherf, Behrmann, &

Dahld, 2012), questions regarding the role of hormonal changes in the recognition of expressions could be raised. For example, among adults, changes in hormone levels induced in the laboratory influence the capacity to recognize emotions (Marsh, Yu, Pine, & Blair, 2010; Fischer-Shofty, Shamay-Tsoory, Harari, & Levkovitz, 2010). There is however a gap in the scientific literature regarding such data concerning the adolescent population in which the hormonal level changes occur naturally.

During adolescence there is a progressive increase in interest in relations with peers, and a withdrawal from the family (Arnett, 2013). It also during this period that trials of social roles that will be adopted during adulthood are attempted. During this stage of the life cycle, there is also a phenomenon called invisible audience, in which adolescents are constantly concerned about external evaluations by peers, even if they are alone (Galanaki, 2012; Somerville, 2013). Considering the importance given to social interactions in adolescence, interventions using emotion expression recognition training for disorders can have a higher degree of responsiveness with this age group and can serve as preventive interventions (Wölver, Frommann, Halfmann, Piaszek, Streit & Gabel, 2005 ; Suzuki, Hoshino, Shigemasu, & Kawamura, 2006).

As there are biological changes at the endocrine system level (Arnett, 2013) together with an increased interest in interpersonal relations, the adolescence is the ideal period to investigate how the identification of expressions develops, a topic which the scientific community is not in full agreement (Pollak, Cicchetti, & Hornung, 2000). There are two opposing positions that are grounded in evidence, the first, argues that this capability is inherent in human development (Johnson, Dziurawiec, Ellis, & Morton, 1991), the second is established from the perspective that a gradual learning with social contacts modulates this ability (Batty & Taylor, 2006).

It is important to investigate how the recognition of expressions develops because if it is established in a purely innate way, interventions aimed at training the recognition of expressions would hypothetically become ineffective. However, a point to be considered in this struggle is the possibility of a mutual interaction between innate aspects and life experiences, from the establishment of an integrative perspective. This position could potentially support evidence of innate and learned characteristics, but further research on the topic is required since interactions between innate and experienced characteristics may have opposing effects, for example, there is

evidence that neurocognitive dysfunctions may lead to deficits in identifying expressions of fear in antisocial populations, for example, psychopaths (Marsh & Blair, 2008). In contrast, children living in hazardous locations have an advantage in recognizing these emotion expressions (Smith & Walden, 1998).

Another point of difference is the definition of how different moderators influence the recognition of expressions (Hampson Anders, & Mullin, 2006; Montirosso et al., 2010). The literature suggests that sex, verbal ability, socio economic status and socialization are the main moderators (Herba & Phillips, 2004; Herba et al., 2008), but due to lack of the standardization in the method of different researches, contradictory data were obtained becoming unclear the effect of moderator variables and questioning the relation between the results of different surveys (Hampson et al., 2006; Herba & Phillips, 2004), a phenomenon which is a shared methodological limitation between some studies on the subject.

Another limitation of studies in the topic lies in the fact that most studies used predominantly stimuli containing adult photos (McClure, 2000) even when investigating children and adolescents. Whereas there may be a bias that makes the subjects worse in recognizing expressions of other people who are not in their age group (Ebner & Johnson, 2009), studies comparing scores between different ages may need appropriate stimuli. Thus the development of an instrument with subjects of different ages during the adolescence could be used to study this effect in addition to investigate the bias phenomenon related to age itself.

With the realization of this study, we intend to contribute to the resolution of methodological flaws founded in the scientific literature regarding the lack of standardization of moderating effects, and the lack of studies on the topic of the influence of socialization and hormonal changes in the recognition of facial expressions. Through the creation of an image set, we have the objective of developing a tool that can be used in researches with teenagers about the theme. Another objective is to clarify the interrelations between the different moderating variables present in the recognition of expressions, so far no studies have controlled all variables simultaneously. The core objectives of the study are detailed below.

Objectives:

General objective

The general objective of this research was to investigate the processing of facial affect recognition in adolescents and young adults. To do so, two studies were developed:

(1) The development of an image set with pictorial stimuli depicting facial expressions in male and female adolescents and young adults.

(2) The investigation of the effects of variables such as age, sex, social interaction, degree of hormonal development, and verbal IQ in the processing of facial affect recognition (accuracy) of adolescents and young adults.

Specific objectives:

Study 1:

- to develop an image set composed by photographs of male and female adolescents and young adults (age range 12 to 20 years) displaying the six emotion expressions of happiness, sadness, anger, fear, disgust, and surprise. Neutral facial expressions were included as well in order to be used in future researches, as they could be confused with others expressions by participants with clinical disorders such as depression or social phobia.

Study 2:

- to investigate the effect of age in the recognition of facial expressions in adolescents and young adults in 200ms, 500ms and 1000ms;

- to identify the effect of sex in the recognition of facial expressions in adolescents and young adults in 200ms, 500ms and 1000ms;

- to investigate the effect of social contact in the recognition in facial expressions in adolescents and young adults in 200ms, 500ms and 1000ms;

- to investigate the effect of the hormonal development in the recognition of facial expressions in adolescents and young adults in 200ms, 500ms and 1000ms; and

- to investigate the effect of the verbal IQ in the recognition of facial expressions in adolescents and young adults in 200ms 500ms and 1000ms.

Hypotheses:

H0: There are no age, sex, social contact, hormonal development and verbal IQ influences in the accuracy of emotion recognition in adolescents and young adults.

H1: Adolescents of 12-14 years will be less accurate in recognizing facial expressions than those of 15-16, and 17-18 years and young adults (19-20 years);

H2: Female adolescents and young adults will have higher accuracy in recognizing facial expressions than male ones;

H3: The amount of social contact will influence the recognition of facial expressions as adolescents and young adults with higher degrees of social contact will be more accurate in recognizing expression than adolescents and young adults with a lesser degree of social contact.

H4: The degree of hormonal development will affect the accuracy in recognizing facial expressions as adolescents and young adults who have started the puberty onset later will be less accurate than those who experienced an early onset.

H5: Verbal IQ will influence the accuracy in recognizing emotion expressions as adolescents with a higher verbal IQ will be more accurate than those with a lower verbal IQ

This study employed a cross-sectional correlation design. It was composed of two studies, the first, called “Youth Facial Affect Expression Set - Development and validation” had the objective of filling the gap with regard to the lack of an image set covering the adolescence and its transition to adulthood. To do so 31 participants (14 male, $M_{\text{age}} = 17.4$, $SD = 2.7$) were recorded watching visual stimuli, posing expressions, and reacting to emotive scenarios. A total of 2297 frames were obtained, from them, 42 were selected, standardized and validated in order to be used in Study 2. The whole process of development of this image set is presented in full version in Chapter 2.

The second study, called “Effect of socialization, sex, age, pubertal development and verbal IQ in facial affect recognition in adolescents and young adults” aimed to analyze the effects of social interaction, pubertal development and verbal IQ on the recognition of expressions at different exposure times (200ms, 500ms and 1000ms). A total of 91 participants (44 males, $M_{\text{age}} = 16.7$, $SD = 2.4$) were divided into four age groups: 12-14 ($n = 23$), 15-16 ($n = 19$), 17-18 ($n = 24$), and 19-20 years ($n = 25$) and completed an experimental task with the 42 validated frames from Study 1 in which presentation speed was varied (200ms, 500ms and 1000ms). The results revealed a inversely proportional influence between the frequency of

social interactions per week and accuracy in the recognition of expressions of anger and disgust, both at 500ms. Verbal IQ was significantly related to accuracy in identifying expressions of surprise, disgust, and anger, all in 500ms. The study is presented in full version in Chapter 3.

References

- Ali, H. B., Powers, D. M., Leibbrandt, R., & Lewis, T. (2011). Comparison of region based and weighted principal component analysis and locally salient ica in terms of facial expression recognition. In *Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing 2011*, 81-89. Springer Berlin Heidelberg.
- Arnett, J. (2013). *Adolescence and emerging adulthood: A cultural approach*. Editora Pearson
- Batty, M., Taylor, M. (2006). The development of emotional face processing during childhood. *Developmental Science*, 9(2), 207-220.
- Barrett, K. (1993). The development of nonverbal communication of emotion: A functionalist perspective. *Journal of Nonverbal Behavior*.17(3),145-169.
- Bell, T. (1806). *Essays on the anatomy of expressions*. Londres. Longman, Hurst, Rees e Ormes, 1806.
- Brown, L., Cohen, A. (2010). Facial emotion recognition in schizotypy: the role of accuracy and social cognitive bias. *Journal of the international neuropsychological society*, 16(3), 474 – 483.
- Calder, A; Keane, J; Manly, T; Sprengelmeyer, R; Scott, S; Nimmo-Smith, I; Young, A. (2003). Facial expression recognition across the adult life span. *Neuropsychologia*, 41(2),195-202.
- Cohn, J. F., & Ekman, P. (2005). Measuring facial action. *The new handbook of methods in nonverbal behavior research*, 9-64.
- Darwin, C. (2009). *The expression of the emotions in man and animals*. Harper Collins Publishers, (obra original publicada em 1872).
- Ebner, N., Johnson, M. (2009). Young and older emotional faces are there age groups differences in expression identification and memory. *Emotion*, 9(3), 329-339.
- Ekman, P. (2003). *Emotions revealed: Recognizing faces and feelings to improve communication and emotional life*. New York: Henry Holt and Company

- Ekman, P., Soreson, R., Friesen, W. (1969). Pan-cultural elements in facial display of emotions. *Science*, *164*(3875), 86-88.
- Fischer-Shoftya, M; Shamay-Tsoorya, G; Harari, H; Levkovitz, Y.(2010) The effect of intranasal administration of oxytocin on fear recognition. *Neuropsychologia*(48),179-184.
- Fridlund, Alan. (1994) *Human Facial Expression: an evolutionary view*. California: Academic Press.
- Galanaki, E. (2012) The imaginary Audience and the Personal Fable: A test of Elkind's Theory of Adolescent Egocentrism. *Psychology*.3(6),457-466.
- Ganel, T; Valyear, K; Goshen-Gottstein, Y; Goodale, M. (2005). The involvement of the "fusiform face area" in processing facial expression. *Neuropsychologia*, *43*,1645-1654.
- Goeleven, E; Raed, R; Leyman, L; Verschuere, B. (2008). The Karolinska Directed Emotional Faces: A validation Study. *Cognition & Emotion*. *22*(6), 1094-1118.
- Hampson, E., Anders, S., Mullin, L. (2006). A female advantage in the recognition of emotional facial expressions: test of an evolutionary hypothesis. *Evolution and Human Behavior*, *27*(6), 401-416.
- Herba, C., Phillis M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: behavioral and neurological perspectives. *Child Psychology and Psychiatry*, *45*(7), 1185–1198.
- Herba, C., Benson, P., Landau, S., Russel, T., Goodwin, C., Lemche, E., Santosh, P., Philips, M. (2008). Impact of familiarity upon children's developing facial expression recognition. *Journal of child psychology and psychiatry*, *49*(2), 201-210.
- Hunter, L. R., Buckner, J. D., & Schmidt, N. B. (2009). Interpreting facial expressions: The influence of social anxiety, emotional valence, and race. *Journal of Anxiety Disorders*, *23*(4), 482-488.
- Izard, C. E., & Malatesta, C. Z. (1987). Perspectives on emotional development I: Differential emotions theory of early emotional development. In *The first draft of this paper was based*

on an invited address to the Eastern Psychological Association, Apr 1, 1983.. John Wiley & Sons.

- Johnson, M., Dziurawiec S., Ellis, H., Morton, J. (1991). Newborn's preferential tracking of face-like stimuli and its subsequent decline. *Cognition*, 40(1-2), 1-19.
- Lagner, O, Dotsch, R, Bijlstra, G; Wigboldus, D. (2010). Presentation and validation of the Radboud Faces Database. *Cognition and Emotion*, 24(8). 1377-1388.
- Leppänen, J. M., Moulson, M. C., Vogel-Farley, V. K., & Nelson, C. A. (2007). An ERP study of emotional face processing in the adult and infant brain. *Child development*, 78(1), 232-245.
- Littlewort, G; Whitehill, J; Wu, T; Ian, F; Frank, M; Movellan, J; Bartlett, M. (2011) The computer expression recognition toolbox (CERT). *Automatic Face & Gesture Recognition and Workshops (FG 2011)*, 298-305
- Marsh, A; Blair, R. (2008). Deficits in facial affect recognition among antisocial populations: A meta-analysis. *Neuroscience and Biobehavioral reviews*. 32, 454-465.
- Marsh, A; Yu, H; Pine, D; Blair. (2010). Oxytocin improves specific recognition of positive facial expressions. *Psychopharmacology*. 2009, 225-232.
- McClure, E; Pope, K; Hoberman, A; Pine, D; Leibenluft, E. (2003). Facial expression recognition in adolescents with mood and anxiety disorders. *The American Journal of Psychiatry*; 160(6).
- McGivern, R., Andersen, J., Byrd, D., Mutter, K., Reilly, J. (2002). Cognitive efficiency on a match to sample task decreases at the onset of puberty in children. *Brain and Cognition*, 50(1), 73-89.
- Montirosso, R., Peverelli, M., Parini, B., Frigerio, E., Crespi, M., Borgatti, R. (2010). The development of dynamic facial expression recognition at different intensities in 4 – to 18 years-old. *Social Development*, 19(1), 71-92.
- Pollak, S., Cicchetti, D., Hornung, K., Reed, A. (2000). Recognizing emotions in faces: developmental effects of child abuse and neglect. *Developmental Psychology*, 36(5), 679–688.

- Pollak, S., Sinha, P.(2002). Effects on early experience on children's recognition of facial display of emotions. *Developmental psychology*, 38(5), 784-791.
- Romani, A; Vieira, B; Mottin, C; Hertzog, D; Arteché, A. (2015). Child Emotions Picture Set (CEPS): Development of a database of children's emotional expression. *Psychology & Neuroscience*.
- Scherf, S; Behrmann, M. & Dahl, R. (2012). Facing changes and changing faces in adolescence: a new model for investigating adolescent-specific interactions between pubertal, brain and behavioral development. *Developmental cognitive Neuroscience*.2, 199-219.
- Sergerie, K; Chochol, C; Armony, J. (2008). The role of the amygdala in emotional processing: A quantitative meta-analysis of functional neuroimaging studies. *Neuroscience and Biobehavioral Reviews*.32, 811-830.
- Simonian, S; Beidel, D; Turner, S; Berkes, J; Long, J. (2001). Recognition of Facial Affect by Children and Adolescents Diagnosed with Social Phobia. *Child Psychiatry and Human Development*. 32(2).
- Smith, M; Walden T. (1998). Development trends in emotion understanding among a diverse sample of african-american preschool children. *Journal of applied developmental psychology*. 19.(2), 177-192.
- Somerville, L. (2013). The Teenage Brain: Sensitivity to Social Evaluation. *Current Directions in Psychological Science*.22(121).
- Suzuki, A; Hoshino, T; Shigemasu, K; Kawamutra, M. (2006). Decline or improvement? Age-related differences in facial expression recognition. *Biological Psychology*.74, 75-84.
- Wagner, H. Methods for the study of facial behavior (1998) in, *The Psychology of facial expressions*. Russel J., Fernández-Dols (ed). Cambridge university Press.
- Wilson, K; Juodis, M; Porter, S. (2011). Fear and Loathing in Psychopaths: A Meta-Analytic investigation of the Facial Affect Recognition Deficit. *Criminal Justice and Behavior*. 38(7), 659-668.

Wölver, W; Frommann, F; Halfmann, S; Piaszek, A; Streit, M; Gaebel, W. (2005)
Remediation of impairments in facial affect recognition in schizophrenia: Efficacy and
specificity of a new training program. *Schizophrenia Research*.80, 295-303.

Chapter 4: General Discussion

Summary of results:

The main objective of this dissertation was to investigate the effects of the moderator agents' socialization, pubertal development and verbal IQ in the recognition of facial expressions by adolescents and young adults. Thus, a second objective was formulated: the development of a database containing images of faces of teenagers and young adults with the six basic emotions (happiness, anger, sadness, surprise, disgust and fear) as well as neutral expressions. In order to achieve those objectives this dissertation was spliced in two studies.

The first study "Development of the Youth Emotion Picture Set (Yeps)", as the name suggests, was about the development of a set of images to be used in study 2 and in another researches on the subject. In order to obtain the facial expressions 31 participants of both genders with age ranging from 12-20 years old were recorded in three different kind of tasks: hearing emotive scenarios, stories in which participants had to imagine themselves at and pose an expressions regarding the situation, posed expressions and reactions to visual stimuli. A total of 42 frames (Appendice 4) , 3 for every basic emotion and 3 neutral frames, sex even, were selected by a panel of expert judges and have been validated for use in study 2.

The Study 2, " Effect of socialization, sex, age, pubertal development and verbal IQ in facial affect recognition in teenagers and young adults" aimed to investigate simultaneously the effects of moderators' agents that until now had been studied scattered throughout researches about expressions. As expected, there was an age effect, with young teens being less accurate than late teens and young adults. Contrary to what had been predicted, the number of friends had little influence in the recognition of expressions, affecting only the recognition of expressions of happy faces, the number of social contacts, on the other hand influenced expressions of anger and disgust, in an inversely proportional relationship. The pubertal development was only related with expressions of happy faces. A sex effect was only founded for expressions of disgust and surprise, with girls being more accurate than boys; finally, the verbal IQ was shown as the moderator agent of disgust and anger in a directly proportional relationship between verbal IQ scores and the accuracy of those expressions. Thus it was founded that some moderators are shared by specific emotions, but none of them affected all emotions. In the appendices section are presented some of the instruments used for the data collection (Appendices 5, 6).

Limitations and Recommendations for Future Research

It should be considered that some limitations have been occurred in the two studies. Despite using techniques previously tested in inducing expressions, the visual stimuli indicated in the literature could not be used for ethical reasons. This way even if the selected stimuli have fulfilled the prerequisites given by the literature, with the exception of the movie used for sad expressions, it was the first time that the visual stimuli were used in a research with the propose of induce emotions. Apart from this, the visual stimuli had the instruction order that subjects should act naturally when watching the videos, which led to sudden changes of face angles, and the gaze direction, decreasing the effectiveness of the method. Also as the visual stimuli were the last method used to capture expressions of the participants. they may have been influenced by a fatigue effect. The weak points of the Study 2 consisted of the fact that the instruments used to assess the pubertal development were from the self-report modality, which may have led to some participants did not have answered it with sincerity. Also the current stage of the menstrual cycle of female participants did not were controlled, and this variable could have influenced the accuracy of fear expressions in female participants. Finally, once were used images of expressions at high intensity, the effects of the moderators in lower intensities expressions were not able to be verified.

Further studies may use emotive scenarios in order to analyze a possible interaction between personality traits and the degree of expressiveness for specific emotions, as personal characteristics and personal backgrounds appeared to influence the type and degree of intensity of expressions made in the subjects exposed to this kind of stimuli. From research on this topic would be possible discover new variables that could affect non-verbal communication, and studies about this topic may pave a new way for the establishment of baselines that could be used in forensic psychology for lie detection.

In addition, future research related to the degree of socialization and recognition of facial expressions can be conducted with participants who study in boarding schools, common schools, or who have received home schooling. This way the amount of indirect contact and exposure to faces of another teenager could be better controlled. Finally, we also suggest studies with of other age groups with teenagers as control group in order to check if there is an age group effect in recognition of expressions.

Conclusion

The recognition of facial expressions are one of the oldest forms of interpersonal communication (Fridlund, 1994), but it remains as an important aspect of interpersonal relationships as it allows behaviors to be adapted to the situations (Lee, et al., 2013), making possible a higher degree of interpersonal interactions quality (Suzuki, Hoshino, Shigemasu & Kawamura, 2006). Studies on the subject during the adolescence are important, because this is a period related to a bigger vulnerability to emotional disorders (Dahl, 2004) and as interpersonal interactions are predictors of a higher social adjustment in adulthood (Parker & Asher, 1987) and related to better self-esteem (Keefe & Berndt, 1996), they can serve as protective factors.

Although the facial expressions are a field with great potential for application and interaction with different areas such as clinical psychology and computer science, research on the subject have found mixed results in some specific topics such as a possible gender effects (Scherf, Behrmann & Dahl, 2012). These divergences are result of a lack in standardization in the method and controlled variables (Herba & Phillips, 2004). In addition, there are possible moderator effects as the pubertal development and the verbal IQ that lack of researches on their effect on the recognition of expressions, and there wasn't an instrument with images of all the teenage years with the six basic emotions.

This dissertation aimed to fill these gaps. Concerning the lack of an instrument, it was developed an image set that could be used in another researches about facial expression recognition with teenagers and other age groups, and can also be used in the development of clinical interventions based on expressions of recognition training for disorders such as social phobia. In regard the lack of standardization, a study controlling the main moderator effects (socio-economic status, gender and Verbal IQ), as well pubertal development and socialization. From the results it's possible to conclude that different moderators' effects could be shared by different kinds of emotions, but there isn't a moderator that affect all the emotions.

References:

- Dahl, R. E. (2004). Adolescent brain development: a period of vulnerabilities and opportunities. Keynote address. *Annals of the New York Academy of Sciences*, 1021(1), 1-22.
- Lee, N., Krabbendam, L., White, T., Meeter, M., Banaschewski, T., Barker, G., Bokde, A., Büchel, C., Conrod, P., Flor, H., Frouin, V., Heinz, A., Garavan, H., Gowland, P., Itterman, B., Mann, K., Paillère Martinot, M., Nees, F., Paus, T., Pausova, Z., Rietschel, M., Robbins, T., Fauth-Bühler, M., Smolka, M., Gallinat, J., Schumman, G., Shergil, S. (2013). Do you see what I see? Sex differences in the discrimination of facial emotions during adolescence. *Emotion*, 13(6), 1030–1040.
- Fridlund, Alan (1994). *Human Facial Expression: an evolutionary view*. Academic Press.
- Herba, C., Phillips, M. (2004). Annotation: Development of facial expression recognition from childhood to adolescence: behavioral and neurological perspectives. *Child Psychology and Psychiatry*, 45(7), 1185–1198.
- Keefe, K., & Berndt, T. J. (1996). Relations of friendship quality to self-esteem in early adolescence. *The Journal of Early Adolescence*, 16(1), 110-129.
- Parker, J. G., & Asher, S. R. (1987). Peer relations and later personal adjustment: Are low-accepted children at risk?. *Psychological Bulletin*, 102(3), 357.
- Scherf, S; Behrmann, M. & Dahl, R. (2012). Facing changes and changing faces in adolescence: a new model for investigating adolescent-specific interactions between pubertal, brain and behavioral development. *Developmental Cognitive Neuroscience*. 2. 199-219.
- Suzuki, A; Hoshino, T; Shigemasu, K; Kawamutra, M. (2006). Decline or improvement? Age-related differences in facial expression recognition. *Biological Psychology*. 74, 75-84.

4. APPENDICES

Appendice 1: Carta de Aprovação SIPESQ



SIPESQ
Sistema de Pesquisas da PUCRS



Código SIPESQ: 6174

Porto Alegre, 5 de maio de 2015.

Prezado(a) Pesquisador(a),

A Comissão Científica da FACULDADE DE PSICOLOGIA da PUCRS apreciou e aprovou o Projeto de Pesquisa "Processamento de Expressões Faciais na Adolescência: Construção de um banco de Imagens e Investigação dos efeitos moderadores." coordenado por ADRIANE XAVIER ARTECHE. Caso este projeto necessite apreciação do Comitê de Ética em Pesquisa (CEP) e/ou da Comissão de Ética no Uso de Animais (CEUA), toda a documentação anexa deve ser idêntica à documentação enviada ao CEP/CEUA, juntamente com o Documento Unificado gerado pelo SIPESQ.

Atenciosamente,

Comissão Científica da FACULDADE DE PSICOLOGIA

Appendice 2: Parecer consubstanciado do CEP

PONTIFÍCIA UNIVERSIDADE
CATÓLICA DO RIO GRANDE
DO SUL - PUC/RS



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Processamento de Expressões Faciais de Jovens: Construção de um banco de imagens e Investigação dos efeitos moderadores.

Pesquisador: Adriane Arteche

Área Temática:

Versão: 2

CAAE: 44988715.5.0000.5336

Instituição Proponente: UNIAO BRASILEIRA DE EDUCACAO E ASSISTENCIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.130.416

Data da Relatoria: 16/07/2015

Apresentação do Projeto:

Projeto de Mestrado na área de Cognição Humana do Programa de Pós-Graduação em Psicologia. Como temática principal tem a identificação de expressões faciais em adolescentes e será realizado em parceria com escolas do interior do Rio

Grande do Sul, baseado no paradigma da psicologia do desenvolvimento com evidências de estudos na área de psicologia cognitiva e neuropsicologia.

Possui dois estudos:

1. Construção de um banco de imagens de faces de adolescentes de ambos os sexos.
2. Investigação do grau de influencia das variáveis moderadoras idade, sexo, socialização, nível de desenvolvimento hormonal e QI verbal no processamento de expressões faciais (acurácia e intensidade) em adolescentes.

Objetivo da Pesquisa:

Investigar o processamento de expressões faciais em adolescentes de 12 a 20 anos.

Estudo 1:

Endereço: Av. Ipiranga, 6681, prédio 40, sala 505
 Bairro: Partenon CEP: 90.619-900
 UF: RS Município: PORTO ALEGRE
 Telefone: (51)3320-3345 Fax: (51)3320-3345 E-mail: cep@pucrs.br

Continuação do Parecer: 1.130.416

- Construir um banco de imagens no qual estarão inclusas fotografias de adolescentes do sexo masculino e feminino em três faixas etárias diferentes: 12-14 anos, 15-16 anos, 17-18 anos e 19-20 anos, que representem as expressões de alegria, tristeza, raiva, medo, nojo, surpresa e neutralidade;

Estudo 2:

- Investigar o efeito da idade no reconhecimento de expressões faciais de adolescentes;
- Identificar o efeito do sexo no reconhecimento de expressões faciais de adolescentes;
- Investigar o efeito da socialização dos adolescentes no processo de reconhecimento de expressões faciais de adolescentes;
- Investigar o efeito do nível de desenvolvimento hormonal no reconhecimento de expressões faciais de adolescentes
- Investigar o efeito do QI verbal no reconhecimento de expressões faciais de adolescentes. (N = 164 adolescentes)

Avaliação dos Riscos e Benefícios:

Risco mínimo para o voluntário (cansaço em responder os questionários)

Comentários e Considerações sobre a Pesquisa:

Delineamento quantitativo, transversal correlacional.

Considerações sobre os Termos de apresentação obrigatória:

Linguagem mais acessível no termo de consentimento livre e esclarecido: "banco de imagens", "QI verbal" (trocar ou explicar o que é).

Não foi apresentado um Termo de Assentimento.

Não foi apresentado um Termo de Confidencialidade do Pesquisador em relação ao uso do banco de imagens.

Recomendações:

Sugere-se empregar uma linguagem mais acessível no TCLE, mais especificamente em relação a "banco de imagens" e "QI verbal".

Esclarecer a utilização do banco de imagens, e especificar quem terá acesso a esse material.

Sugere-se no título da pesquisa substituir o termo "adolescentes" por "jovens", uma vez que "adolescente",

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Continuação do Parecer: 1.130.416

em termos jurídicos, é específico para pessoas com até 18 anos.

Indica-se a inclusão de um Termo de Assentimento do participante no estudo.

Acrescentar na documentação um Termo de Confidencialidade do Pesquisador para o uso do banco de imagens.

Conclusões ou Pendências e Lista de Inadequações:

Foram atendidas todas as solicitações de informações e revisão.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

PORTO ALEGRE, 29 de Junho de 2015

Assinado por:
Rodolfo Herberto Schneider
(Coordenador)

Appendice 3: Comprovante de submissão a revista científica (Qualis A2)

The screenshot shows a web browser window with the URL <https://www.editorialmanager.com/ipbs/default.aspx>. The page header includes the journal title "Integrative Psychological & Behavioral Science" and the Editorial Manager logo. The user is logged in as "Author" with the username "brunovello".

The main content area is titled "Submissions Being Processed for Author Bruno Martins Novello". It displays a table with one submission record:

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links		Development of the Youth Emotion Picture Set (YEPs)	Dec 16, 2015	Dec 16, 2015	Submitted

Navigation links include "HOME", "LOGOUT", "HELP", "REGISTER", "UPDATE MY INFORMATION", "JOURNAL OVERVIEW", "MAIN MENU", "CONTACT US", "SUBMIT A MANUSCRIPT", and "INSTRUCTIONS FOR AUTHORS". A button labeled "<< Author Main Menu" is located at the bottom of the submission list.

The Windows taskbar at the bottom shows the search bar "Pesquisar na Web e no Windows", several application icons, and the system tray with the time "12:51" and date "16/12/2015".