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Are concepts of achievement-related emotions universal across cultures? A semantic profiling approach

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Research indicates that cognitive representations of lexical meaning (i.e. semantic concepts) of emotions such as joy, anger, or sadness are remarkably similar within and across languages and cultures (Fontaine et al., 2013). This work provides substantial evidence for the assumption that data on human emotional experience based on emotion words used as stimuli or in response scales, can be meaningfully compared across individuals and cultures. However, Fontaine et al. (2013) focused on concepts of decontextualised emotions presented as words without accompanying cues about situational context and the events that generated the emotion. To date, it remains unclear whether cross-cultural conceptual similarity extends to contextualised emotions that are characterised by a specific object focus, such as achievement-related emotions, definable as affective states tied to experiences of success or failure (e.g. Pekrun, 2018). Examples include well-studied emotions such as anxiety about an upcoming test, or pride resulting from personal success, as well as emotions that have received less empirical attention, such as despair over repeated failure.

Importantly, recent work suggests that concepts of decontextualised emotions can differ from concepts of achievement-related emotions (Gentsch et al.,

2018), such that clarification regarding their cross-cultural generalisability is needed. This need is exacerbated by the fact that scientific interest in these emotions will likely continue to grow in our modern achievement-focused societies, particularly due to the functional importance of these emotions for health, well-being, and performance in educational, occupational, and athletic settings (Pekrun, 2018; Shockley et al., 2012).

Against this background, we examined Canadian, German, Colombian, and Chinese university students' concepts of 16 achievement-related emotions using the Achievement Emotions CoreGRID (AECG). The AECG is a context-specific version of Fontaine et al.'s (2013) short variant of the GRID (i.e. CoreGRID), a tool for examining semantic concepts of emotions. In a grid-like format, the AECG includes 84 columns representing different features of emotions, and 16 rows representing emotion words. The grid's cells contain the perceived typicality rating (i.e. likelihood of occurrence) given by participants to each feature for each emotion denoted by a respective word. This semantic profiling approach yields profiles that reflect individuals' conceptual knowledge of prototypical features of emotions held to represent "average" recurrent affective experience in a language community, and that is stored in the mental lexicons of its members for a given emotion word.

The GRID builds on a definition of emotions as multicomponent processes involving characteristic changes in five organismic subsystems (i.e. components), namely (1) affective feelings, (2) cognition, (3) motivational tendencies, (4) physiology, and (5) expression (e.g. Scherer, 2009). The features in the GRID were selected to capture possible changes within these components, based on an extensive review of different emotion theories (Fontaine et al., 2013; see supplemental material). In line with these assumptions, control-value theory (CVT; Pekrun, 2018) conceptualises achievement-related emotions as consisting of coordinated processes involving: (1) *affective components,* or feelings (e.g. positive excitement connected to enjoyment); (2) *cognitive components* consisting of emotion-specific thoughts (e.g. confidence in personal ability); (3) *motivational components* encompassing behavioural tendencies (e.g. motivation to invest effort); (4) *physiological components* comprising changes in the peripheral autonomic nervous system (e.g. increased heartrate); and (5) *expressive components* including facial, postural, and vocal expression (e.g. speaking in a firm voice). Based on this premise, the AECG assesses concepts of achievement-related emotions in terms of their typical component features (see method section). Similarity of concepts of *achievement-related* emotions was examined for overall profiles comprising all features, and separately for each emotion component to explore whether cross-cultural similarity differs across components.

Achievement-related emotions as a function of sociocultural context

In line with appraisal theories of emotion (Scherer & Moors, 2019), CVT proposes that sociocultural context can influence achievement-related emotions by shaping emotion-arousing appraisals of control over, and value of, achievement tasks and outcomes. Cross-cultural research indeed documents substantial differences in students' achievement-related emotions. In a study by Frenzel and colleagues (2007), Chinese students reported higher levels of achievement-related enjoyment, pride, anxiety, and shame, whereas German students reported more anger. These findings are consistent with evidence suggesting that anger is less acceptable in collectivist Asian as compared with Western cultures (Hofstede, 2001) and findings from the 2015 OECD-Programme for International Student Assessment (PISA) including 72 countries, which revealed particularly high levels of achievement-related anxiety in East Asian students. Evidence for cultural differences in emotion-generative appraisals underlying such findings is less conclusive. It has been hypothesised that emotions should differ between cultures that emphasise intrinsic values of learning and those that foreground the importance of achievement, with the former facilitating enjoyment, and the latter facilitating anxiety (see review in Pekrun, 2018). However, in Frenzel et al.'s (2007) study, Chinese students reported both higher enjoyment and anxiety. Overall, substantive evidence for differences in appraisals as drivers of cross-cultural differences in achievement-related emotions is lacking.

In contrast to these mean-level differences in achievement-related emotions, their linkages with control-value appraisals and achievement appear to be consistent across cultures. For instance, in PISA 2015, students' anxiety correlated negatively with science achievement in 52 of 55 participating countries, while relations between enjoyment and achievement were positive in all 68 countries for which this relation was examined. Furthermore,

evidence suggests that appraisal antecedents and motivational functions of achievement-related emotions are similar across individuals, students of different cultures, and educational and occupational achievement settings (Pekrun, 2018; Shockley et al., 2012). These findings corroborate the CVT's proposition that functional mechanisms of emotions are bound to universal characteristics of the human mind and should thus be invariant across individuals and cultures (Pekrun, 2018). This likely extends to core affective properties like valence and arousal (Feldman Barrett & Russell, 1998). In contrast, frequencies, intensities, and physiological and expressive components of achievement emotions may vary as a function of individual temperament and sociocultural norms (Mauss & Butler, 2010; Pekrun, 2018). To date, it remains unclear whether such cultural similarities and differences in *experiences* of achievement-related emotions are reflected in individuals' *concepts* thereof.

Do concepts of achievement-related emotions also vary across sociocultural contexts?

Measurement invariance of constructs across populations is an important precondition for meaningful cross-cultural research, and typically tested using multigroup confirmatory factor analysis. Taking such an approach, Frenzel and colleagues (2007) found that emotions assessed via the Achievement Emotions Questionnaire (Pekrun et al., 2011) were equivalent across Chinese and German students. Additionally, PISA findings point to invariance of achievement-related emotion measures across multinational datasets (Pekrun, 2018). However, this evidence is limited to a small number of emotions. Furthermore, conventional psychometric analysis provides only limited insight into respondents' conceptual understanding of measured constructs. While measurement invariance speaks to factor structure equivalence across groups of respondents, it cannot guarantee that constructs "mean the same thing" to all respondents (Karabenick et al., 2007; supplemental material). Consequently, in-depth inquiry into concepts of achievement-related emotions is needed to gauge their similarity across cultures and ensure meaningful interpretation of findings.

Importantly, concepts of emotions may vary as a function of contextualisation as well. Using the GRID's feature-profiling paradigm, Gentsch et al. (2018) found that German speakers' concepts of decontextualised emotions lacking a specific focus (e.g. anxiety) differ from their concepts of their achievement-related counterparts (i.e. anxiety about failure). For instance, approach-oriented motivational tendencies such as *wanting to tackle the situation* were perceived as more typical for decontextualised than for achievement-related anxiety. Thus, prior research on decontextualised emotions provides limited insight into cross-cultural similarity of contextualised emotion concepts.

Overview of the present research

This study used an adapted version of Fontaine et al.'s (2013) psycholinguistic GRID instrument, the AECG, to examine similarity of concepts of achievement-related emotions across cultures. The AECG has been shown to effectively disclose differences in decontextualised versus achievement-related emotions (Chavarría et al., 2017; Gentsch et al., 2018). It covers 16 positive and negative emotions (Table 1) selected based on theoretical and empirical considerations. Specifically, it covers emotions frequently reported in achievement settings and known to impact performance (Pekrun, 2018) and, as such, incorporated in CVT and established achievement-related emotion measures (e.g. Pekrun

Table 1. Cross-cultural similarity (double-entry intraclass correlations; ICC-DE) of feature profiles of emotions across all 84 features.

Emotion	CA-GE	CA-CO	CA-CH	GE-CO	GE-CH	CO-CH
Joy	.94	.91	.89	.92	.86	.88
Hope	.90	.85	.91	.80	.88	.85
Pride	.92	.91	.90	.91	.89	.89
Relief	.81	.72	.70	.77	.65	.76
Contentment	.87	.72	.79	.83	.79	.86
Anxiety	.82	.87	.82	.80	.64	.75
Anger	.92	.89	.89	.88	.82	.86
Frustration	.76	.62	.51	.85	.75	.81
Shame	.87	.83	.81	.88	.73	.76
Guilt	.88	.87	.75	.85	.70	.75
Disappointment	.89	.88	.86	.88	.80	.82
Sadness	.90	.90	.88	.91	.78	.80
Hopelessness	.91	.91	.87	.91	.82	.85
Despair	.87	.65	.90	.78	.78	.67
Boredom	.88	.60	.04	.51	−.06	.26
Surprise	.85	.86	.61	.74	.56	.67

Note. Columns 2–7 define the six cultural pairs for which emotion profile correlations (ICC-DEs) were computed. CA = Canadian sample, GE = German sample, CO = Colombian sample, and CH = Chinese sample.

Given $k = 84$ features, all ICC-DEs $\geq .22$ are significant at $p < .05$. Positive ICC-DEs indicate higher levels of similarity, negative values indicate lower levels of similarity.

et al., 2011). Additionally, we selected emotions relevant to success and failure as proposed in the literature (e.g. Graham & Taylor, 2014) that have received less attention (e.g. relief, frustration), particularly regarding their conceptual representation.

To probe universality of emotion concepts, we collected data in four countries varying in terms of geographic, cultural, and linguistic proximity. We selected three countries representing Western cultures (Canada, Germany, Colombia) and one representing Eastern culture (China) to provide the grounds for comparing emotion concepts across individualistic Western and collectivistic East Asian countries commonly hypothesised to endorse different achievement values. Furthermore, we selected countries of variable linguistic relatedness by covering three languages belonging to the broader Indo-European family, two West Germanic languages (English, German) and one Italic Romance language (Spanish), and one representative of the Sino-Tibetan family (Chinese).

Based on Fontaine et al.'s (2013) evidence for substantial convergence of emotion concepts across cultures, we expected high cross-cultural similarity of achievement-related emotion concepts as defined by their overall feature profiles. Furthermore, following the relative universality proposition, we expected similarity to be highest for affective, cognitive, and motivational components. Finally, we explored similarity between different cultural pairings. We expected similarity to be highest among (English-)Canadian and German samples given their relative proximity in culture (Hofstede, 2001) and linguistic origin, and higher convergence among the Canadian, German and Colombian samples than between the former and the Chinese sample.

Method

Development and Administration of the AECG

The AECG targets concepts of emotions situated within achievement contexts. It encompasses 84 features covering (sample items in parentheses; complete list in Table S1): (1) affective components including valence (feeling *good*) and arousal (feeling *calm*); (2) cognitive components including appraisals of control (*the success/failure was caused by the person's own behaviour*) and value (*the success/failure was important and relevant to the person's goals or needs*); (3) motivational components including quantity (*the person wanted to do nothing*) and quality of motivation (avoidance – *the person wanted to run away*); (4) physiological components depicting changes in autonomic arousal (*increased heartrate*); and (5) facial, vocal, and postural expression (*frowning, slumping*). Instructions and features of the CoreGRID were reformulated to refer to achievement contexts (see supplemental material). Sixteen new features tapping into proposed characteristics of achievement-related emotions were developed by surveying extant theories on achievement-related emotions (supplemental material). Examples include items targeting attributions of success/failure to personal ability versus effort (Table S1). The German, Colombian Spanish, and Mandarin Chinese AECGs were developed using a translation-back-translation procedure (Fontaine et al., 2013; see Table S2 for emotion word translations).

With 84 features in total, and at least 10 features per component, the AECG-data allows for comparing culture-level emotion concepts by computing "profile" correlations in the form of double-entry intra-class correlations across culture-level mean feature scores. Empirically grounded recommendations suggest that profiles contain at least eight items to ensure sufficient reliability (Rogers et al., 2018). Of note, emotion concept similarity was estimated at the between-variable rather than between-person level (supplemental material).

The AECG was administered via controlled web-studies in two sessions each covering eight emotions (Table S2), with a mandatory break to alleviate fatigue. Participants were informed that the AECG assesses typical characteristics of emotions aroused in achievement settings involving success or failure. School, university, sports, and work were listed as example settings. Participants were given descriptions of all emotion components (Table S3) as well as exemplary ratings for *envy*. They were then asked to imagine a native speaker of the target language and to indicate, "If a person uses the following emotion words in the left-hand column (e.g. *joy*) to describe an emotional experience related to success or failure, how likely is it that … " a given feature (e.g. *smiled*) occurred using a nine-point scale (1 = *extremely unlikely*, 9 = *extremely likely*; Figure S1).

Participants

Sample size planning at the between-person level was based on Fontaine et al.'s (2013) finding that feature ratings based on $n = 25$ participants per culture yield reliable within-culture conceptual profiles and allow for robust comparisons between cultures. Data were collected from 126 university

students recruited via mailing lists and bulletin boards. Recruitment procedures specified that participants were native speakers of the respective language. Informed consent was obtained from all participants. The research was conducted in accordance with the American Psychological Association ethical principles and the institutional requirements at the respective universities.

The Canadian (CA) sample included 25 students of a Canadian university (20 female, $M_{age} = 20.72$ years, $SD = 2.69$) with different majors, including biology, neuroscience, and psychology. Students received $20 for participating.

The German (GE) sample included 29 psychology students of a German university (26 female, $M_{age} = 21.07$ years, $SD = 3.68$). Students received course credit for participating. Parts of these data were used by Gentsch et al. (2018).[1]

The Spanish (CO) sample included 42 psychology students of a Colombian university (22 female, $M_{age} = 21.76$ years, $SD = 3.47$). In accordance with the local research protocol, no compensation was provided. Parts of these data were used by Chavarría et al. (2017)[1].

The Chinese (CH) sample included 30 students of a Chinese university (22 female, $M_{age} = 20.00$ years, $SD = 0.87$) with different majors, including psychology and math. In accordance with the local research protocol, no compensation was provided.

Preliminary analysis

We first examined absolute within-sample agreement on the profiles of each emotion by computing intraclass correlations (ICC) based on two-way random-effects models (type "average of *k* raters"). AECG features were treated as cases, and individuals' ratings of these features for a given emotion as variables (see supplemental material) using the R-package "irr" (Gamer et al., 2019). ICC-ranges were .92–.97 for the Canadian, .94–.98 for the German, .96–.99 for the Colombian, and .89 –.98 for the Chinese sample (see Table S4 for ICCs and CIs), indicating excellent within-sample agreement. Convergence also extended to component-level agreement (Table S5).

Analysis of cross-cultural emotion profile similarity

Given high within-culture agreement, we computed culture-level likelihood ratings for each feature of each emotion. Cross-cultural similarity of feature profiles of each emotion was examined separately for all six cultural pairings using double-entry ICCs (ICC-DE; Hřebíčková et al., 2018) across all 84 features, and separately for each emotion component, using the R-package "psych" (Revelle, 2018).

In personality psychology, ICC-DEs are used as an index of profile similarity that integrates elevation, scatter, and shape of personality profiles of two individuals. Thus, ICC-DEs provide more conservative estimates than Pearson *r* which only indexes shape similarity in patterns of highs and lows. Similar to this study, ICC-DEs have also been used to examine cross-cultural similarity of culture-level personality traits (e.g. Hřebíčková et al., 2018). They are estimated as correlations between two doubly entered profiles created by appending each profile to the other (see supplemental material).

As suggested by Hřebíčková et al. (2018), interpreting degrees of similarity in terms of the magnitude of profile correlations may be more telling than relying on the absence or presence of statistical significance, especially when the number of profile features is large, as is the case in the present study. We thus focused on evaluating ICC-DEs in terms of their magnitude. As ICC-DEs share core properties with Pearson's *r*, they can be interpreted using established criteria for classifying correlations as low (.10), moderate (.30), or high (.50; Hřebíčková et al., 2018; supplemental material), with higher positive ICC-DEs indicating higher similarity. As strengths and limitations of different profile similarity indexes continue to be debated, we report corresponding *r*s in Tables S6-S7.

Results and discussion

Cross-cultural similarity of feature profiles of emotions

Cross-cultural similarity of the 84-feature profiles of emotions was generally high: Of the 96 ICC-DEs (Table 2), 95.8% were large (>.50), and nearly 80% reached values ≥.75, yielding a grand mean of .79 ($SD = .16$; 95%-CI [.76, .82]). These patterns suggest that, overall, achievement-related emotions are conceptualised in similar ways across our samples.

As indicated by overlapping 95%-CIs, average ICC-DEs across all emotions were of comparable magnitude for the comparisons CA-GE ($M = .87$, $SD = .05$, [.85, .89]), CA-CO ($M = .81$, $SD = .11$, [.76, .86]), and

Table 2. Cross-cultural similarity (double-entry intraclass correlations; ICC-DE) of feature profiles of emotion components.

Emotion	CA-GE	CA-CO	CA-CH	GE-CO	GE-CH	CO-CH
			Affective component			
Joy	.99	.92	.94	.88	.91	.91
Hope	.94	.92	.93	.90	.92	.95
Pride	.96	.96	.96	.92	.97	.92
Relief	.89	.89	.75	.84	.73	.86
Contentment	.96	.90	.89	.92	.91	.93
Anxiety	.88	.97	.88	.83	.68	.95
Anger	.91	.94	.83	.87	.66	.79
Frustration	.91	.84	.91	.90	.89	.87
Shame	.92	.90	.76	.89	.73	.79
Guilt	.97	.92	.77	.95	.73	.75
Disappointment	.95	.93	.92	.92	.84	.82
Sadness	.95	.93	.88	.93	.82	.79
Hopelessness	.97	.94	.84	.96	.79	.81
Despair	.89	.86	.92	.94	.85	.86
Boredom	.84	.55	.42	.56	.35	.87
Surprise	.81	.92	.83	.67	.67	.87
			Cognitive component			
Joy	.94	.91	.92	.93	.86	.93
Hope	.87	.81	.85	.76	.83	.91
Pride	.94	.90	.92	.91	.90	.93
Relief	.88	.74	.66	.75	.60	.86
Contentment	.86	.73	.81	.91	.88	.93
Anxiety	.74	.84	.86	.76	.73	.89
Anger	.87	.88	.88	.88	.82	.83
Frustration	.84	.85	.85	.92	.74	.86
Shame	.80	.70	.74	.82	.70	.76
Guilt	.89	.79	.68	.71	.62	.80
Disappointment	.84	.84	.81	.87	.78	.86
Sadness	.82	.86	.92	.82	.83	.86
Hopelessness	.87	.85	.91	.85	.81	.89
Despair	.86	.79	.85	.84	.82	.78
Boredom	.81	.15	-.15	-.08	-.37	.81
Surprise	.84	.65	.37	.57	.26	.71
			Motivational component			
Joy	.95	.88	.86	.92	.85	.86
Hope	.94	.96	.96	.93	.92	.97
Pride	.92	.93	.85	.88	.86	.81
Relief	.88	.78	.78	.90	.84	.87
Contentment	.87	.72	.84	.88	.86	.88
Anxiety	.91	.87	.80	.78	.65	.90
Anger	.97	.87	.81	.86	.81	.93
Frustration	.93	.69	.69	.78	.80	.88
Shame	.97	.91	.82	.89	.81	.72
Guilt	.94	.97	.78	.94	.72	.75
Disappointment	.94	.85	.85	.80	.76	.86
Sadness	.93	.86	.86	.84	.76	.74
Hopelessness	.91	.96	.86	.89	.83	.87
Despair	.85	.89	.94	.93	.76	.85
Boredom	.90	.74	.35	.64	.21	.69
Surprise	.55	.56	.33	.43	.20	.68
			Physiological component			
Joy	.90	.90	.95	.91	.95	.95
Hope	.78	.10	.81	-.02	.82	-.17
Pride	.89	.83	.94	.84	.97	.91
Relief	.79	.57	.61	.44	.43	.91
Contentment	.79	.37	.52	.24	.36	.85
Anxiety	.90	.86	.75	.79	.64	.80
Anger	.97	.93	.96	.87	.89	.97
Frustration	.53	.40	-.23	.47	.23	.01
Shame	.71	.54	.48	.69	.56	.82
Guilt	.85	.70	.43	.46	.49	.30
Disappointment	.88	.83	.87	.72	.81	.79
Sadness	.92	.96	.73	.90	.68	.81
Hopelessness	.88	.65	.77	.80	.80	.85
Despair	.67	-.25	.77	.33	.38	-.56
Boredom	.90	.76	-.67	.88	-.61	-.55
Surprise	.87	.93	.76	.81	.76	.74
			Expressive component			
Joy	.91	.90	.80	.95	.74	.79
Hope	.88	.78	.88	.80	.83	.64
Pride	.89	.87	.87	.93	.79	.86
Relief	.52	.44	.55	.67	.38	.70
Contentment	.79	.55	.65	.75	.61	.83
Anxiety	.67	.81	.76	.80	.36	.67
Anger	.90	.85	.91	.90	.85	.83
Frustration	.39	.14	.05	.81	.67	.92
Shame	.85	.88	.90	.97	.72	.78
Guilt	.75	.84	.85	.95	.78	.88
Disappointment	.88	.92	.88	.96	.81	.86
Sadness	.88	.92	.91	.99	.79	.85
Hopelessness	.92	.93	.88	.98	.85	.64
Despair	.94	.55	.92	.68	.85	.43
Boredom	.88	.68	.04	.48	-.04	-.01
Surprise	.92	.95	.59	.91	.68	.64

Note. Columns 2–7 define the cultural pairs for which emotion profile correlations (ICC-DEs) were computed. CA = Canadian sample, GE = German sample, CO = Colombian sample, and CH = Chinese sample. For the affective component, ICC-DEs $\geq$ .55 are significant at $p < .05$ (based on $k = 10$ features). For the cognitive component, ICC-DEs $\geq$ .32 are significant at $p < .05$ (based on $k = 28$ features). For the motivational component, ICC-DEs $\geq$ .41 are significant at $p < .05$ (based on $k = 18$ features). For the physiological component, ICC-DEs $\geq$ .50 are significant at $p < .05$ (based on $k = 12$ features). For the expressive component, ICC-DEs $\geq$ .43 are significant at $p < .05$ (based on $k = 16$ features). Positive ICCs indicate higher levels of similarity, negative values indicate lower levels of similarity.

GE-CO ($M = .83$, $SD = .10$, [.78, .88]). In contrast, average ICC-DEs for comparisons involving the Chinese sample fell below .80 (CA-CH: $M = .76$, $SD = .22$, [.65, .89]; GE-CH: $M = .71$, $SD = .22$, [.60, .82]; CO-CH: $M = .77$, $SD = .15$, [.70, .84]) and were thus slightly lower, descriptively speaking (Figure S1). Furthermore, similarity across the Canadian and German samples was, on average, higher than for GE-CH and CO-CH comparisons (see non-overlapping CIs), which corresponds to our hypothesis suggesting similarity should be highest among Western samples.

Average cross-cultural similarities exceeded .70 for all emotions except boredom ($M = .37$, $SD = .36$; Figure S3). While boredom profiles were highly similar for CA-GE (.88), CA-CO (.60), and GE-CO (.51) comparisons, ICC-DEs for comparisons involving the Chinese sample fell below .26, indicating discrepancies. These findings echo Ng et al.'s (2015) study indicating that

experiences of boredom may be contingent on cultural background and more closely associated with unpleasant states implying high arousal (agitation) in Canadian versus Chinese university students, which may be attributable to cultural differences in ideal affect. We explore whether these patterns extend to *concepts* of achievement-related boredom below.

Although to a much lesser extent than for boredom, ICC-DEs for frustration and surprise also varied more (*SD*s ≥.12) than for the remaining emotions (*SD*s < .10). Previous GRID-based research on concepts of decontextualised frustration and surprise also points to variation: English *frustration* more closely resembles prototypical English *anger* than its Spanish, French, and German cognates (Soriano & Ogarkova, 2015), and English *surprise* may be less "surprising" in terms of suddenness and novelty (Soriano et al., 2015), than its translation-equivalents in other languages. These findings point to variation in affective, cognitive, and expressive components of these emotions in the absence of a specific context. Below, we explore whether these patterns hold for achievement-related frustration and surprise.

Cross-cultural similarity of feature profiles of emotion components

With 89.8% of ICC-DEs reaching values >.50 (Table 2), component-level similarity was, overall, also high. Again, ICC-DEs < .50 were most common for comparisons involving the Chinese sample. Furthermore, as indicated by overlapping 95%-CIs, average component-level ICC-DEs across emotions and cultural comparisons were high, and of comparable magnitude, for affective ($M = .86$, $SD = .11$, [.84, .88]), cognitive ($M = .78$, $SD = .22$, [.74, .82]), and motivational components ($M = .82$, $SD = .15$, [.79, .85]). Average similarities for these components were higher than for the physiological component ($M = .63$, $SD = .38$, [.55, .71]). Moreover, similarity was higher for affective versus expressive features ($M = .75$, $SD = .22$, [.71, .79]; Figure S4). These patterns support our hypothesis that similarity might be highest for affective, cognitive, and motivational components. Given ongoing discussions about cultural variation in emotional expression and research suggesting that expression may be more susceptible to cultural influence than physiological responding (Soto et al., 2005), it is surprising that similarity was lowest for the latter. One explanation may be that internal physiological changes are less accessible to individuals (Evers et al., 2014), such that conceptual representations thereof may be less refined.

ICC-DEs < .50 were most common for boredom, frustration, and surprise. In contrast to the aforementioned evidence for cross-cultural conceptual variation in decontextualised frustration and surprise, but in line with our hypotheses, variation for achievement-related frustration was largely restricted to physiological and expressive components. For surprise, however, motivational tendencies varied most ($M = .46$, $SD = .16$), contrary to our expectations. Similarity was lowest for CA-CH and GE-CH comparisons. Since motivational impulses resulting from surprising achievement outcomes can depend on outcome valence (success/positive vs. failure/unpleasant; Gendolla & Koller, 2001), we examined whether culture-level ratings for feeling *good* and *bad* differed between these pairs. Overlapping 95%-CIs (Table S7) suggest this was not the case. Variation in perceived motivational characteristics of surprise was thus not accompanied by variation in valence and warrants further inquiry.

Strongest discrepancies occurred for physiological components of boredom when contrasting Chinese with Canadian (-.67), German (-.61), and Colombian (-.55) ratings. Thus, low similarity between the Chinese concept of boredom and its Canadian, German, and Colombian counterparts are largely attributable to discrepant perceptions of physiological characteristics. We examine these unparalleled discrepancies in more depth below.

Follow-up analyses: Physiological components of boredom

Given high similarity (ICC-DEs ≥.76) in physiological characteristics of boredom among the Canadian, German, and Colombian samples, we combined their ratings for each of the 12 physiological features and compared them to the Chinese ratings using Bonferroni–Holm corrected *t*-tests. Significant differences emerged for 11 features (Table S9). Contrary to Ng et al.'s (2015) findings on experiences of general state boredom, achievement-related boredom was conceptualised as more physiologically arousing (i.e. features like *rapid heartrate* or *sweating* were rated as more likely) among Chinese raters. This low correspondence in perceived characteristics of boredom may be due to the Chinese translation chosen in this study, *yàn fán*, denoting annoyance/irritation resulting from boredom. In contrast, the variant *yàn juàn*

implies deactivation/fatigue, which may correspond more closely to typical Canadian, German, and Colombian boredom concepts (see supplemental material for further discussion). To test this explanation in future work, the AECG can be used to assess Chinese perceptions of characteristics of boredom denoted by different labels.

Conclusions

This study examined cross-cultural similarity of concepts of achievement-related emotions using semantic feature-profiling, and found that these emotions are generally conceptualised in similar ways across Canadian, German, Colombian, and Chinese samples. While corroborating previous work on cross-cultural measurement invariance of self-report instruments targeting achievement emotions, our findings extend this work in two important ways. First, we examined a broader variety of previously understudied emotions relevant to achievement. Second, we employed a more fine-grained approach to assessing cultural understanding of emotions. Overall, the findings speak to the robustness of emotion concepts both within and across different languages and cultures, suggesting that confidence in cross-cultural research on achievement-related emotions is indeed warranted.

However, our findings also point to variation. First, consensus was most pronounced for affective, cognitive, and motivational components. For physiological and expressive components, similarity was less pronounced. Second, similarity was highest among the Canadian, German, and Colombian samples; comparisons with the Chinese sample yielded lower convergence. These findings imply that some facets of achievement-related emotion concepts may be more invariant than others, and that invariance may depend on the languages and cultures considered. Thus, in conducting cross-cultural research on achievement-related emotions, caution may be warranted as well, particularly when using self-report in which levels of emotions are derived from items targeting different emotion components. Future work is needed to map out potential boundaries of conceptual invariance, and to investigate associated consequences for cross-cultural research on achievement-related emotions.

Several limitations of our study provide directions for future research. First, our samples consisted of university students and were predominantly female, reflecting typical gender compositions of student populations in psychology and related majors. Thus, the question of gender-dependent achievement emotion concepts may arise. Evidence for gender effects on emotion concepts is scarce. Extant GRID-based research suggests that differences may be negligible (Fontaine et al., 2013). Nevertheless, empirical verification of invariance of achievement emotion concepts across different genders is needed considering extant evidence for differences in male and female emotional responding and regulation: Research on achievement emotions, for instance, consistently yields higher levels of self-reported test or math anxiety for females (Pekrun, 2018) which may result from differences in item understanding entailing different thresholds for item endorsement. Furthermore, as samples were drawn from student populations, it is likely the context participants had in mind when completing the AECG was an academic one. Future studies should consider sampling individuals at different educational levels and in other achievement contexts like work or sports, or adapt instructions to prompt specific achievement contexts, to further pin down the degree to which emotion concepts are sensitive to specific characteristics of context as well as developmental factors. This can be extended by comparing concepts of emotions with different object foci, such as achievement and social emotions (e.g. anger about personal failure vs. about a partner's unforgiveness).

Second, probing invariance of emotion concepts across additional languages and cultures is important for confirming the stability of our findings. Future work could employ the AECG to disentangle the relative impact of language and culture on conceptual similarity by comparing emotion concepts between samples representing variants of the same language, such as different varieties of Spanish. Our findings attest to the generalisability of concepts of achievement-related emotions across four linguistically and culturally distinct samples, but continuing research in this direction will shed light on the necessity for, and inform the design of, culture-sensitive measures of emotions.

Note

1. Parts of the data reported in this study have been analysed in previous research. Gentsch et al. (2018) used feature ratings for joy, pride, contentment, anxiety,

anger, shame, guilt, disappointment, sadness, despair, surprise to examine effects of contextualisation on German speakers' emotion concepts. Their analyses focused on a subset of 65 features and 11 emotions common to the AECG and original GRID. Chavarría et al. (2017) examined differences in Colombian individuals' concepts of motivational components of achievement-related versus decontextualised emotions. This study used the complete GE/CO-datasets in conjunction with two new datasets and presents novel data addressing a new research question.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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