Exploring Affective Responses to Different Exercise Intensities in Low-Active Young Adolescents

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Adolescence provides a significant opportunity to influence attitudes toward activity. It has been proposed that affective responses are the first link in the hypothesized exercise intensity–affect–adherence chain. The aim of this study was to explore young low-active adolescents’ affective responses to different exercise intensities using quantitative and qualitative methodologies. Participants completed 15 min of exercise at four exercise intensities: three set in relation to the participants’ ventilatory threshold (above, at, and below) and one self-selected. Affective valence was measured before, during, and after exercise, and participants were interviewed about their responses. Patterns in affective responses in quantitative data support tenets of the dual-mode theory. Qualitative data were presented as four narrative stories, and dominant themes associated with affective responses were identified. Consideration of individual preferences in the prescription of exercise, prescribing exercise set below the ventilatory threshold, or encouraging adolescents to self-select exercise intensity could positively influence adolescents’ exercise experiences.

Keywords: affective responses, adolescents, exercise, dose response, dual-mode theory, ventilatory threshold

Physical activity levels are low among young people in countries around the world. It is reported that less than two-thirds of all young people participate in sufficient physical activity to benefit their present and future health and well-being (World Health Organization, 2004). In England, 32% of boys and 24% of girls (aged 2–15 years) reach the recommended levels of physical activity to benefit their health (Craig, Mindell, & Hirani, 2009). After the ages of 11 in girls and 15 in boys there are significant declines in physical activity levels (Department of Health, 2004), and the American College of Sports Medicine guidelines (American College of Sports Medicine, 2010) state that “recent trends show physical activity levels decreasing through adolescence . . . , such that the majority of adolescents are not participating in sufficient amounts of physical activity to meet recommended guidelines” (p. 187).

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This highlights the considerable opportunity that adolescence provides to intervene and influence factors that may be associated with physical activity behavior. Adolescents who emerge from their school years feeling confident about their physical skills and bodies, and who have had positive experiences of physical activity, are more likely to be active through their adulthood (Department of Health, 2004). Theoretically, competence-based approaches (e.g., Bandura, 1997; Harter, 1978) could explain this line of reasoning; however, it could also be explained by the affective responses associated with physical activity.

A variety of theories developed to explain behavior are associated with the pleasure or displeasure linked to the behavior. Williams (2008) described these under the umbrella term of hedonic theory, where behavior can be explained as a function of the affective consequences or anticipation of the affective consequences associated with the behavior. Recent applications of hedonic theory to physical activity behavior (that individuals will seek to repeat experiences they have enjoyed and avoid experiences they have found aversive) have supported the principles that a more pleasurable experience will lead to increases in (Williams et al., 2008), or may influence (Kiviniemi, Voss-Humke, & Seifert, 2007), physical activity behavior.

There is a growing amount of literature focused on the acute affective responses of adults to exercise and how these responses vary relative to the exercise intensity stimulus. Understanding how exercise of a given intensity can cause adolescents to feel may provide valuable information, especially if affective changes related to a specific exercise-intensity play an important role in exercise adherence (Williams et al. 2008). Research with adult populations has shown that the amount of time individuals choose to spend exercising is predicted by the affect experienced in that situation (Emmons & Diener, 1986; Schneider, Dunn, & Cooper, 2009a; Williams et al., 2008).

The exercise intensity–affect relationship can be explained by the dual-mode theory (see Ekkekakis, 2003, for an introduction to the theory). Developed from an evolutionary adaptive perspective, the theory proposes that there are two factors that underlie affective responses: cognitive appraisal processes (e.g., self-efficacy, attributions, goal achievements, personality variables) and physiological variables that reflect metabolic strain (e.g., signals from baroreceptors, thermoreceptors, and visceroreceptors in the muscles, heart, and lungs, etc). The theory proposes the dual influence of these two general factors on affective responses. According to the theory, neither factor is likely to have complete control over affective responses; rather, the balance of control is hypothesized to shift as a function of exercise intensity (Ekkekakis, 2003). At low-intensity exercise (below the ventilatory threshold [VT]), cognitive processes are suggested to have a small-to-moderate influence on the affective response, with interoceptive cues associated with the metabolic strain having little influence. The responses are hypothesized to be homogenous and positive. At intensities around the VT, the interoceptive cues continue to have only a small impact and cognitive processes become the main determinant of affective responses. The cognitive appraisal process is unique to the individual. At this intensity, affective responses are suggested to vary between individuals due to factors such as different interpretations of exercise intensity and personality traits. At high intensities (above the VT), interoceptive cues gain salience and become the main determinant of affective responses. At this intensity, the maintenance of metabolic rate requires increased contributions from anaerobic
Sources and physiological steady state cannot be maintained. Consequently, affective responses are proposed to be uniformly less positive, with little interindividual variability because the physiological cues signal physical harm and that the individual should stop exercising (Ekkekakis, 2003). Upon the cessation of the exercise, the predominant response is expected to be a robust rebound toward pleasure. According to Solomon (1991), this is because of the adaptational benefit associated with the removal or termination of a noxious or aversive stimulus and the return to affective equilibrium (Ekkekakis, Hall, & Petruzzello, 2005a).

Several studies have provided support for the dual-mode theory. Studies have mapped the affective and physiological responses to maximal incremental tests and demonstrated a shift from positive to negative affect at the transition from aerobic to anaerobic metabolism in active (Ekkekakis, Hall, & Petruzzello, 2004) and sedentary adults (Welch, Hulley, Ferguson, & Beauchamp, 2007) and active children (Sheppard & Parfitt, 2008). Data support the uniform decline in affect above VT (Ekkekakis et al., 2004) but indicate variability close to VT especially in sedentary adults (Welch et al., 2007) and active children (Sheppard & Parfitt, 2008). In addition, quasi-experimental studies with participants exercising at intensities set relative to their individual VT have confirmed the hypothesized decline during exercise above VT, but a positive response below VT in healthy active adults (Ekkekakis, Hall, & Petruzzello, 2008), sedentary men (Parfitt, Rose, & Burgess, 2006), sedentary women (Rose & Parfitt, 2007), and active children (Sheppard & Parfitt, 2008). Finally, analyses of individual responses support the homogeneity of response above the VT, with approximately 80% of participants declining in affect in the above VT condition, compared with variability in affect close to VT (Ekkekakis et al., 2008; Rose & Parfitt, 2007; Parfitt et al., 2006). Qualitative data (Rose & Parfitt, 2007) support interindividual variability in responses at different intensities and the role of cognitive factors (for example, perception of ability, interpretation of the intensity, outcomes from exercise), and the interpretation of the interoceptive cues during exercise at the different exercise intensities.

Research examining affective responses has also considered the physiological and psychological effect of self-selecting exercise intensity (e.g., Lind, Joens-Matre, & Ekkekakis, 2005; Parfitt et al., 2006; Rose & Parfitt, 2007, 2010; Vazou-Ekkekakis & Ekkekakis, 2009). Allowing individuals to self-select their preferred exercise intensity is a concept that may have important implications for increasing physical activity levels in the general public (Ekkekakis, 2009; Parfitt, Rose, & Markland, 2000; Williams, 2008). Preferred intensity can be described as the exercise intensity level favored by a person during exercise and refers to the level of exercise that an individual chooses when given the option to set the intensity him- or herself. Research has consistently shown that adults self-select exercise intensities that are, on average, within a recommended range for cardiorespiratory fitness and health (Ekkekakis, 2009; Lind et al., 2005; Lind, Ekkekakis, & Vazou, 2008; Parfitt et al., 2006; Rose & Parfitt, 2007; Vazou-Ekkekakis & Ekkekakis, 2009). The advantage of a self-selected protocol from a motivational perspective is clear. It provides the individual the opportunity to experience a sense of control (autonomy) over his or her exercise environment (Rose & Parfitt, 2010; Vazou-Ekkekakis & Ekkekakis, 2009). More autonomous forms of behavior regulation have been shown to result in more positive affective responses and greater levels of enjoyment (Vallerand & Rousseau, 2001), and enjoyment has been shown to be an important factor associated
Research has begun to examine how active adolescents affectively respond to exercise of different intensities (Schneider et al. 2009a, Schneider, Graham, Grant, King, & Cooper, 2009b; Sheppard & Parfitt, 2008) but more research is needed. It would be valuable to understand what adolescents are attributing pleasant and unpleasant affective responses to, and to try to identify if there are common factors behind the homogenous affective responses at prescribed exercise intensities. In addition, neither adolescent responses to self-selected exercise nor the responses of low-active adolescents, who have a preference for, and tolerance of, low-intensity activity (personality dispositions that are theorized to influence affective responses to acute intensity exercise: Ekkekakis, Hall, & Petruzzello, 2005b), have been considered. These could be argued to be the individuals who could benefit the most from this line of research. Further, if professionals involved in the delivery of physical activity want to change rates of uptake and adherence to physical activity through increased positive exercise experiences, it may be valuable to identify constructs that are associated with affective responses. This could help professionals to intervene more effectively and influence the way in which adolescents are introduced to exercise of different intensities. Ultimately, this approach could help lead to the adoption of, and adherence to, greater levels of exercise behavior.

The aim of the current study is twofold: (1) To quantitatively investigate affective responses of young low-active adolescents to four exercise intensities. It is hypothesized that affective responses will follow the proposals of the dual-mode model; positive and stable at intensities below the VT, positive but variable responses at VT, and uniformly negative at intensities above the VT; and affective responses in the self-selected intensity will be positive and stable; and (2) to qualitatively investigate the factors (cognitive and physiological) that were reflectively associated with affective responses and changes in response as a function of exercise intensity, and compare responses associated with the self-selected intensity condition with those of the prescribed exercise conditions. It is hypothesized that identified themes associated with affective responses will be similar to those identified in adults.

**Methods**

**Participants**

Twenty-six young adolescents (12 boys, 14 girls; \(M_{\text{age}} 12.5 \pm .5 \text{ years} \)) were recruited into the study using two questionnaires: Children’s Leisure Activity Study Survey (CLASS; Telford, Salmon, Jolley, & Crawford, 2004) and the Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q; Ekkekakis et al., 2005b). The CLASS is a self-report questionnaire that was developed specifically for 10- to 12-year-old children. It can be used to assess children’s weekly levels of physical activity. The test–retest reliability (percentage agreement) ranges between 62% and 94%. The PRETIE-Q is used to assess the trait variables of preference for, and tolerance of, exercise intensity. Internal consistency ranges between .81 and .85 for the preference scale and .82 and .87 for the tolerance scale (Ekkekakis et al., 2005b). Individuals who reported both low activity levels and a preference and tolerance for low-intensity exercise (operationalized as those recording the lowest

with exercise maintenance (Mullan & Markland, 1997; Rhodes, Fiala, & Conner, 2009; Rhodes & Pfaeffli, 2010).
tertile scores from a cohort of adolescents) were invited to participate in the study. All participants were asymptomatic of illness and preexisting injury and were able to exercise to exhaustion. The participant, as well as their parent or guardian, read and signed informed consent forms approved by the university’s ethics committee.

**Measures**

**Affective Valence.** Affective valence was assessed using the Feeling Scale (FS; Hardy & Rejeski, 1989). The FS is an 11-point, single-item, bipolar scale that is commonly used for the assessment of affective responses during exercise. The scale ranges from –5 to +5. Anchors are provided at zero, and at all odd integers (+5 = very good; +3 = good; +1 = fairly good; 0 = neutral; –1 = fairly bad; –3 = bad; –5 = very bad). The FS has been found to correlate between .51 and .88 with the Valence scale of the Self Assessment Manikin (SAM; Lang, 1980) and from .41 to .59 with the Valence scale of the Affect Grid (Van Landuyt, Ekkekakis, Hall, & Petruzzello, 2000) and has been successfully used with adolescents (Schneider et al., 2009a, 2009b; Sheppard & Parfitt, 2008).

**Perceived Exertion.** Perceived exertion was used as a manipulation check and was assessed using the Cart and Load Effort Rating scale (CALER; Eston, Parfitt, Lamb, & Campbell, 2000). The CALER has a 1–10 range of numbers and verbal expressions chosen by children as descriptors of exercise effort. Wording on the scale has been selected from the Children’s Effort Rating Table (CERT: Williams, Eston, & Furlong, 1994), and accompanies some of the categories of effort. Reliability of the scale has been shown to be between .65 and .98 (Eston et al., 2000).

**Procedures**

**Quantitative Procedures.** On arrival at the laboratory on the first occasion, participants were briefed on procedures for the maximal test and any outstanding questions were addressed. Mass and stature were recorded and participants were asked to complete a brief questionnaire about their activity and fitness levels. Questions asked how active (inactive to highly active) and fit (unfit to very fit) participants perceived themselves to be on scales ranging from 1 to 4.

Selected participants took part in five laboratory-based exercise tests (one graded maximal exercise test [GXT] and four submaximal tests) over a period of a month. Descriptions of the GXT protocols can be found elsewhere (see Sheppard & Parfitt, 2008). In the four submaximal tests, participants warmed up for 3 min against a light resistance and then exercised for 15 min, maintaining a cadence of 70 ± 10 rpm. The cycle ergometer was loaded for each participant using individual VT data from the GXT, to elicit a response at one of three intensities: below-VT (80% of VT power output), at-VT (individually determined from GXT, 100% of VT power output), and above-VT (130% of VT power output). A self-selected intensity was also set by asking the participant to “select an intensity that you would be able to do for fifteen minutes and that you would consider doing regularly” (adapted from Parfitt et al., 2000). Participants were told that they could modify the self-selected intensity during the test at min 5 and min 10 if they wished. Any adjustments made to the exercise intensity were recorded.
Responses to the FS were taken 5 min before the start of the test and immediately preexercise. Participants were asked for FS and CALER responses in the last 45 s of each 5-min period (Minutes 5, 10, and 15). Postexercise responses (FS) were taken immediately on cessation of exercise (Post 0), 5 min after (Post 5, after the cool-down), 10 min after (Post 10), 15 min after (Post 15), and 30 min after (Post 30).

**Qualitative Procedures.** At the end of each of the four submaximal tests, after a standardized cool-down and rest period, participants were interviewed (one-to-one) about their exercise experience and questioned on the FS responses that they had given before, during, and after exercise. Interviews were carried out in the laboratory and were recorded on a Microcassette-corder M-450. Participants had been familiarized with the environment and had the opportunity to develop a relationship with the researcher. Interviewees were reminded that they were free to stop the interview at any time if they were unhappy or uncomfortable with questions. It was clearly emphasized to participants that there were no right or wrong answers, and that the aim of questioning was to better understand the reasons for their affective responses. It was explained that questions would follow a semistructured format, using open-ended questions to gain as much detail as possible and that silences and long pauses were to be expected and were to allow time for either interviewee or interviewer to think. Questions about FS responses were associated with time points in the test and followed a basic structure: “When you started the test you were feeling ____ on the FS scale. Can you tell me what was making you feel like this?” and “____ minutes into the test you were feeling ____ on the FS scale. Can you tell me what was making you feel like this?” Responses were followed up with probes where necessary. Interviews lasted on average between 10 and 15 min.

The methodological approach taken in the study aimed to control experimental conditions, so that affective valence responses generated in the exercise conditions were minimally influenced by other factors and could confidently be compared across participants. In this study, a highly homogeneous sample of healthy, low-active (defined as not reaching the government physical activity guidelines of 60 accumulated min per day), young adolescents who specified a preference for and tolerance of low-intensity exercise were recruited. Social factors were eliminated in the laboratory to minimize variability in affective valence responses. Finally, results remained confidential. The same researcher collected the data, and, during the quantitative section of data collection, interaction between the researcher and participant was kept to a minimum.

**Planned Analysis**

**Quantitative.** Analyses were split into four sections: descriptive statistics, a manipulation check (to confirm that participants worked at different intensities between conditions), a two-factor repeated-measures ANOVA on FS responses and interindividual variability analysis of FS responses (to test the proposals of the dual-mode theory and self-select hypotheses). Descriptive statistics were generated for the boys’ and girls’ data separately and independent t tests were conducted to explore any differences between genders on VO2max, body mass index, fitness and activity levels. The manipulation check and analysis of the FS responses used two-factor (Time × Condition) ANOVA. All statistically significant findings were
followed up using Tukey post hoc tests. Where the assumption of sphericity was violated, degrees of freedom were corrected with Greenhouse-Geisser epsilon. Finally, the interindividual variability in FS responses was analyzed to investigate the frequencies with which participants reported improvements, decrements, or no changes in FS responses during exercise.

**Qualitative.** Interviews were audiotaped and transcribed verbatim. The transcripts were read several times to allow familiarization with the data and to identify key emerging areas of interest. An ethnographic fiction approach was used to present the data. Ethnographic fictions are based on real data, real people, and real events. Stories are created that are fiction in form but factual in content. The fictional techniques are used “to convey the author’s understanding of the situation” (Sparkes, 2002, p. 161). Facts are taken from the raw data, from the comments of the participants. Rinehart (1998) explains that the “fundamental thrust of fictional ethnography is to get at both the affective feel of the experience and the cognitive ‘truth’ of it” (p. 204). The authors want readers to see a snapshot of the researcher’s experience in order to appreciate something of the feelings that young adolescents described to be associated with their affective responses during exercise. The words of the participants and their recorded comments are used.

It is suggested that well-written stories can allow a reader to gain insight into the world of others (Rinehart, 1998) and allow the reader to “imaginatively feel their way into the experiences that are described by the author” (Denzin, 1997, p. 12). It is proposed that using stories to represent research in this way can prevent hasty judgments on understanding of the data and allow space for alternative interpretations to be made (Sparkes, 2002).

From the 26 transcripts, common themes and raw data quotations that captured distinct concepts were identified and plotlines were developed. The trustworthiness of the data analysis was assessed by a second researcher who read the transcripts and checked the clarity of the common themes. Both researchers were responsible for developing the plotlines and assessed the truthful portrayal of plotlines in each other’s work. Plotlines are general story types that represent an amalgamation of many of the stories from the participants’ experiences at each intensity. It is therefore unlikely that an individual’s story would match exactly to the idealized version. The dual-mode theory was used as the theoretical framework to guide the analysis and themes that have previously been identified in qualitative data of affective responses in adult women were used as a source of reference (Rose & Parfitt, 2007).

**Quantitative Results**

**Participants**

Descriptive data for participants can be seen in Table 1. The participants predominately had low levels of aerobic fitness. Independent t tests revealed no significant gender differences.

**Manipulation check**

**Cart and Load Effort Rating scale (CALER).** Two-factor repeated-measures ANOVA of the CALER data revealed a significant (Time × Condition) interaction,
Post hoc analysis showed there was a significant increase at Minute 10 and Minute 15 in the above-VT intensity condition compared with all other intensity conditions (see Figure 1). A significant main effect was found for condition, $F(3, 69) = 70.2, p < .01, \eta^2 = .75$, with the above-VT ($M = 6.38 \pm .95$) intensity condition significantly higher than all other conditions, and below-VT ($M = 2.92 \pm 1.03$) and at-VT ($M = 3.81 \pm 1.04$) intensity conditions also significantly different from each other. A main effect for time, $F(1.2, 27.3) = 45.3, \varepsilon = .59, p < .01, \eta^2 = .66$ was also found and post hoc analysis revealed Minute 5 to be significantly lower compared with Minutes 10 and 15.

**FS Responses Across Exercise.** In line with the hypotheses, a two-factor repeated-measures ANOVA revealed a significant (Condition $\times$ Time) interaction, $F(27, 621) = 15.0, p < .01, \eta^2 = .40$. Post hoc analysis showed the above-VT intensity condition had significantly less positive FS scores at Minutes 5, 10, 15, Post 0, and Post 5 compared with all other conditions, which remained positive and stable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12.5 (.5)</td>
<td>12.6 (.5)</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.6 (.1)</td>
<td>1.6 (.1)</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>51.3 (15.2)</td>
<td>48.2 (11.4)</td>
</tr>
<tr>
<td>Body Mass Index (kg·m$^{-2}$)</td>
<td>20.4 (4.4)</td>
<td>19.6 (3.5)</td>
</tr>
<tr>
<td>VO$_{2\text{max}}$ (mL·kg$^{-1}$·min$^{-1}$)</td>
<td>38.1 (8.2)</td>
<td>34.1 (5.6)</td>
</tr>
</tbody>
</table>

**Figure 1** — The interaction between time and condition in CALER responses during exercise.
The above-VT was also significantly less positive compared with the self-selected intensity at Post 10. The self-selected intensity condition was significantly more positive compared with the below-VT and at-VT conditions at Minutes 5, 10, and 15 (see Figure 2). Main effect for condition, $F(3, 69) = 23.5, p < .01, \eta^2 = .51$, and time $F(2.7, 63.7) = 40.5, \epsilon = .31, p < .01, \eta^2 = .64$, were due to greater positive affect in the self-selected intensity condition compared with the above-VT intensity condition, and over time FS responses decreased at Minutes 10, 15, and Post 0 compared with all other time points.

**Interindividual Variability.** Descriptive data of the change in FS responses only partially support the hypotheses and indicated that from preexercise to during exercise there was greater interindividual variability during the exercise intensities around and below the ventilatory threshold. In the below-VT intensity condition, 8% of participants increased in their affective valence responses, 54% decreased, and 38% stayed the same. In the at-VT intensity condition, 4% increased in affective valence, 50% decreased, and 46% stayed the same. In the self-selected intensity condition, 8% increased in affective valence, 42% decreased, and 50% remained the same in their responses. In the above-VT intensity condition, no one increased or remained the same, and 100% of participants decreased in affective valence responses (see Table 2).

**Qualitative Results**

**The Stories**

Four different, typical plotlines were identified in the data. Each plotline characterizes each exercise intensity level that the participants had experienced. The plotlines represent the explanations participants gave for the affective responses they experienced during and after the bicycle tests. Every example story characterizes the master narrative for each intensity level because the majority of participants told stories of this type. The exact figures that are represented by these stories can be seen in the interindivudual variability data (Table 2), and the pattern of the FS responses can be found in Figure 2. It was noteworthy that both boys and girls told all of the stories presented.

The stories adhere to a basic structure, which follows the participants’ reflections on their experiences of the bicycle test soon after the experience (about 10–15 min after the test). The participants describe their feelings immediately before the test, during it, and after the test is over. The participants also reflect on what they thought of the test and which of the tests they preferred. Although the stories do follow a similar structure, they differ in terms of content and they are distinguishable by the exercise intensity they describe. Each story is presented in turn, and the major themes that emerge from the narrative are discussed and highlighted using quotes from the raw data.

**Below-VT Intensity Exercise Condition**

**Example Story.** I was feeling very confident before the low-intensity cycle ride. I’d survived the max exercise test and I thought that this one would be easier.
Table 2  Interindividual Variability in FS Responses From Preexercise to During Exercise

<table>
<thead>
<tr>
<th></th>
<th>Below-VT</th>
<th>At-VT</th>
<th>Above-VT</th>
<th>Self-Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Range of FS change (response range)</td>
<td>2 (1 → 3)</td>
<td>2 (1 → 3)</td>
<td>—</td>
<td>2 (3 → 5)</td>
</tr>
<tr>
<td>Average no. of units of change</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td><strong>Decrease</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>14</td>
<td>15</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>Range of FS change (response range)</td>
<td>1–5 (5 → 0.5)</td>
<td>1–5 (5 → 0)</td>
<td>1–8 (5 → –5)</td>
<td>1–5 (5 → 0)</td>
</tr>
<tr>
<td>Average no. of units of change</td>
<td>2.04</td>
<td>2.69</td>
<td>4.23</td>
<td>2.27</td>
</tr>
<tr>
<td><strong>No Change</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>13</td>
</tr>
</tbody>
</table>
It was low intensity so it had to be easier. So I knew from the beginning that it was going to be okay. I knew that I’d have plenty of energy to finish it, so I was feeling good. When I first started I was feeling happy; happy because it was easy cycling, and I was feeling comfortable (no face mask and my legs felt good), but after a while it did start to ache a little. That didn’t feel so good. After 5 min or so I started to get a little hot and my legs started to feel it. My energy was starting to be used up a bit so although it started as easy, it wasn’t so easy in the middle. I did feel a little worse, what with my legs and feet starting to ache just a little. Toward the end the aching was still there, but I knew that I was stopping soon and I would finish it. I knew I’d be able to do it, because I’d done the harder test so I thought this one would be fine. At the end I felt good. I’d finished and felt like I’d achieved something. I did enjoy it, but only a little—it wasn’t really that hard and I could have kept going for longer, I did have some energy left. It’s hard to decide which of the bike rides I preferred—this one was maybe a bit easy, not much of a challenge, so although it made me feel good, it wasn’t really good.

Analysis of the Story. The major themes that dominate the story are confidence, ability, easy challenge, and physiological cues. From the very outset, the knowledge that this was a low-intensity exercise session is associated with feelings of confidence and the expectation that the session was going to be easy: “[I feel] very confident today, because I know it’s low intensity and I think it’s gonna be quite easy” (girl); “[I feel] very confident because it’s low, so it should be easier” (boy). This confidence was described in association with feeling “good” and “fairly good” on the FS.

The story describes the participant feeling happy at the start of the test and this is associated with the easy challenge and perceived ability to complete it. “I’d done a bit, and it wasn’t that hard and I know I can finish it: I wasn’t struggling
so I felt good” (boy) and “I was finding it easier; it wasn’t hard so I knew I could do it” (boy).

From the middle of the exercise test, the participant starts to describes physiological cues: “My stuff started aching and when stuff starts aching it feels like you are working harder, but I was thinking I’m right at the end so I can stop in a second” (boy). Although physiological cues are registered, they are not described strongly and the time remaining and the ability to cope with the exercise intensity are described as in association with feelings attached to them.

The story finishes with the participant reflecting that she or he felt good and had enjoyed the exercise session: “I think I did, yeah it was good, it was better than the other ones [high intensity, and graded exercise test], the other ones were mean, I liked the easiness” (girl).

At-VT Intensity Exercise Condition

Example Story. I felt alright about the test. I was not scared. I didn’t mind if it was a bit hard or a bit easy. I had done a hard test already so I knew I could get through it. When I got into the test I got a bit achy and a bit tired. Then, as it went on, I felt I was just getting more tired and aching more and feeling hot and sweaty. By the end I was just a bit worn out. I had gone for all the time and my legs hurt a bit. There was not that much resistance but there was quite a bit and you had to actually push a bit so the legs were hurting. At the end I was feeling okay and I knew I could finish it and it wasn’t like really, really, hard so I knew I could keep going. At the end of the test, when I had cooled down, I started feeling better again because it was starting to wear off my legs and I had finished it. It was good because it wasn’t really, really, easy; it did have a little bit of pressure so you did actually have to work a little bit. I think the test was sort of challenging but not too challenging.

Analysis of the Story. The major themes that can be identified in this narrative are negative physiological cues, confidence, and challenge.

The story shows the participant feeling physiological cues from the exercise: “[I felt] . . . a bit worn out and legs hurt a bit” (girl) and “I could just feel it on my legs and it was just feeling a bit tougher as I was going along” (girl). The participants did not link the physiological feelings to large negative changes in feeling states. This theme was present during the test and also continued after the test had stopped.

Confidence as a theme is present at the start of the story; participants are influenced by the fact that they had already completed a maximal test and some had completed the above-VT test. “I am feeling really confident because I have done the high one so I know I will be able to do it” (girl) and “[I feel] . . . very confident because it is not going to be a hard one. . . . I know it is not going to be very hard” (boy). Participants associated this confidence with positive feeling states at the start of the test.

Another theme that was identified in the at-VT intensity narrative was challenge. The majority of participants described that the bike test was a good challenge, and they felt as if they had completed something but that it was not too hard: “It was a bit of a challenge but it was not too easy and it was not too hard; it was just like a middle pace” (girl). Participants associated this with their reason for more positive feeling states.
Above-VT Intensity Exercise Condition

Example of the Story. I was quite nervous before doing the high-intensity bike test because I thought it was gonna be hard. I wasn’t very confident that I could do it. I just wanted to get it over and done with. At the start of the test I was feeling good because I hadn’t done much of the test, so I wasn’t feeling very bad yet. My body felt alright; I didn’t feel much change in my legs or anything. When I got five minutes into the test I was feeling fairly good. I started to get a bit tired, my legs started to ache and I didn’t feel as good as I did at the start. I was really having to concentrate on the test and on keeping pedaling at the right speed. By the time I got ten minutes into the test, I started feeling fairly bad. I was feeling so tired, my legs were really aching, I was low on energy and it was my whole body, I just felt bad. In the last five minutes of the test I was feeling very bad. I was so hot and tired, I was sweaty and I was aching everywhere, I wasn’t sure I could keep going but I did. I couldn’t wait to slow down. When the test finished I felt a bit better because it was over, I didn’t have to cycle anymore and I was pleased because I knew I had done it but I still felt bad because I was still hot and tired and my legs were still hurting. After I had done the cool-down I did feel better, my legs had stopped hurting and I felt quite proud of myself because I knew I had completed something and I wasn’t sure that I could at the start. I was quite relieved and quite pleased with myself that I had done it. On the whole I didn’t really enjoy the test. It was hard, it hurt my legs, and it hurt more than the other tests I’d done.

Analysis of the Story. The major themes that can be identified in this narrative are negative physiological cues, confidence, and achievement. The theme that comes through most strongly in the storytelling is the negative physiological cues that are experienced during the bike test. The story shows the participant feeling strong physiological cues from the exercise: “My legs really hurt and I was starting to get tired; it was all my body” (girl) and “I was tired, hot, sweaty and my legs hurt” (girl). These negative physiological cues are described a lot by the participants and dominate as the reason participants gave for reductions in their feeling states. This theme was present during the bike test and also continued after the test had stopped.

A lack of confidence in being able to complete the bike test was evident at the start of the test: “[I feel] nervous because it’s the harder one so it means that I will have to work even harder and it will put a lot of pressure on me so I will have to pedal harder to keep it at the level it has to be at and I don’t know if I can finish it” (girl). Many of the participants worried about their ability to cope with the intensity of the workload on the bike and this was associated with a negative impact on their feeling states.

At the end of the test, the story also shows a feeling of achievement and accomplishment for completing the test: “I know I had completed it and I had finished, which felt good because I had got to the end and completed my goal” (boy). Participants linked their feelings of achievement with improvements in their feeling states.

The story finishes with a reflection on whether the participant enjoyed the test and would do it again. Overall participants did not enjoy the above-VT intensity condition and would not choose to do again: “I didn’t like it, I will stick to the low one because it didn’t hurt as much” (girl) and “No, I don’t like the hard intensity . . . it was hard and it hurt my legs, if I don’t feel good then it’s not good” (girl).
Affect and Exercise Intensities in Low-Active Young Adolescents

Self-Selected Intensity Exercise Condition

Example Story. So how did I feel before the test? I guess I felt OK . . . good actually because I knew I was going to get to choose how hard it was. We don’t get to choose what we normally do when we are in school, so as I got to choose I thought that it would be fun. Yep, I did, I thought that it was going to be fun. I’d done that maximum test, so I knew that I’d be able to do it. I was feeling very confident that I’d be able to do it . . . more confident than I had before. Especially more confident than at the start of the hard [high-intensity] test. I think that knowing that I could change how hard it was made me feel confident. When I actually started, I got it a bit wrong and started to get hot and sweaty and my legs started to ache so I changed it down after the first five minutes . . . you know, made it a little easier, but I didn’t want it to be too easy. I changed it to a level that my legs could take. I changed it up again later because once I was into a rhythm it was easier and I wanted a challenge. The test was fun and I felt like I had done something rather than nothing. It really woke me up and made me feel energized and that I could enjoy the day. I certainly preferred the self-selected condition to the others—it’s a bit like the three bears—the high was too hard, the low was too easy, but the self-select was just right. I was in control and I could choose what to do. When I finished, I felt really good and would have kept going if I’d been allowed to.

Analysis of the Story. The dominant themes in this story are choice, control, confidence, ability, and enjoyment. Even before the session started, the story describes how the participant was looking forward to the fact that there was the element of choice in setting the exercise intensity: “there isn’t much in school that you get to choose, so now I get to choose something I want to do” (boy).

The choice and control allowed in the session were linked (by some) directly to the confidence that they felt: “10 [on a scale of 1 to 10] because I get to choose, so I know I can definitely change it down if I need to” (girl) and “I was quite confident because I knew I could choose it myself and I know the level I was working on so I was confident about it” (girl). Participants stated high confidence as a reason for positive feeling states.

During the actual exercise session, the story describes awareness of physiological sensations (sweating, legs aching) and the participant regulated the exercise intensity to alleviate these feelings so that he or she can continue to feel good: “My legs were saying what was fine for them. I didn’t want to go lower than ‘good’ so I wanted to stay at intensity where my legs didn’t hurt . . . I wanted to feel good” (boy). However, regulating the exercise intensity was also associated with creating and maintaining challenge during the session: “I put the intensity up because I wanted it to be slightly challenging but not too challenging because it’s fun” (boy). Regulating exercise intensity was linked by participants to positive feeling states.

After the session had ended, the story describes how energizing the test made the participant feel: “It was fun . . . I feel like the test woke me up” (boy). The participants gave enjoyment as a reason for positive feeling states or improvements in their feeling states.

In the final reflection on which exercise condition was preferred, it is clear in the story that it is the self-select condition for reasons associated with confidence and control: “the low one was too easy and the high one was too hard, but this one was in the middle so I felt more confident” (boy) and “[I felt] confident and
happier because I know I can set it to what I know I can do, or what I want to do, so I suppose I have freedom of choice and I am in control of it and I don’t have to do what other people tell me to do. I don’t like being told how to exercise, it’s too restrictive” (girl).

Discussion

Our objectives were twofold. First, we wished to quantitatively investigate the affective responses of young low-active adolescents to four exercise intensities, as we hypothesized that affective responses would follow the proposals of the dual-mode theory and affective responses in the self-selected intensity would be positive and stable. Second, we sought to qualitatively investigate the relationship between cognitive and physiological factors and affective valence, which are suggested to change as a function of exercise intensity, and to compare responses associated with the self-selected intensity condition with those of the prescribed exercise conditions. It was hypothesized that identified themes associated with affective responses would be similar to those identified in adults.

Quantitative Discussion

Quantitative data support the proposals of the dual-mode theory and hypothesized responses in the self-select condition, with FS responses more positive in the exercise intensity set below the ventilatory threshold and in the self-selected exercise intensity, compared with exercise set above the ventilatory threshold. Results also revealed a universal improvement in FS responses postexercise across all intensity conditions. The two-factor repeated-measures ANOVA showed a significant difference between FS responses in the above-VT intensity condition and the intensities below the VT (as the dual-mode theory predicts) with a progressive decline in affective valence during the exercise period in the above-VT intensity condition. These FS responses mirror results of previous research with adults (Ekkekakis et al., 2008; Welch et al., 2007) and adolescents (Sheppard & Parfitt, 2008).

Stable positive FS responses in the self-selected intensity condition were found to be significantly more positive than all other conditions at Minutes 5, 10, and 15. This patterning has also been shown in previous research (Rose & Parfitt, 2007; Sheppard & Parfitt, 2008). However, unlike other research in which the participants chose intensity levels close to their ventilatory threshold, these participants selected, on average, intensity level similar to the below-VT intensity level (self-selected intensity was 57.6 ± 13.9 W, compared with below-VT intensity, which was 55 ± 8 W). Clearly, this result could be strongly associated with the fact that participants were recruited for their low activity levels and preference for lower intensity exercise. Nonetheless, it is interesting to note that when these young adolescents self-selected their own exercise intensity, they reported more positive FS scores than during the similar prescribed exercise intensity level.

As hypothesized, the patternings of FS responses of young low-active adolescents do demonstrate support for the dual-mode theory. During intensities below the VT, FS responses remained positive and during intensities above the VT, FS responses became negative. As predicted by the dual-mode theory, there was
variability in FS responses during the at-VT intensity; however, there was also variability in the below-VT intensity. This was not hypothesized and may be due to the type of participant recruited to the study. In line with the theory, there was homogeneity in responses above the VT, with FS responses decreasing in 96% of the participants during the exercise test.

Qualitative Discussion

An admonition when interpreting these data relates to the method by which the data were gathered. The approach used was, by its very nature, investigatory and exploratory. Participants were asked after the exercise test to reflect on why they gave the affective responses they did during and after the test. Researchers have proposed that the participants’ responses may well be inhibited by their own limited self-knowledge. Wilson and Dunn (2004) suggested that a “common source of self-knowledge failure is the inaccessibility of much of the mind to consciousness, including mental processes involved in perception, motor learning, personality, attitudes, and self-esteem. Introspection cannot provide a direct pipeline to these mental processes” (p. 493). With this in mind, the reader should consider that these data are not an exact explanation of the cause of the affective responses but rather evidence of what the individuals thought caused their affective responses.

The findings revealed four main stories, each containing different narratives and as hypothesized many of the identified themes were similar to those reported by Rose and Parfitt (2007, 2010), including themes of confidence, challenge, achievement, control, and enjoyment. However, themes were identified that were not present in this young low-active adolescent population. These were those influenced by exercise outcomes, including the benefits of exercise (health and fitness gains) and the process of exercise (feeling good simply through the process of being active). “Benefits of exercise,” in which the participants were concerned with whether they were gaining benefits and achieving health and fitness gains from the exercise was not identified as a theme in the young adolescents in this study. It is possible that age and lack of experience may have inhibited thoughts on this theme.

Rose and Parfitt (2007) suggest that to achieve a positive affective response, individuals need to experience a combination of factors: to perceive that they have the ability to cope with the intensity and complete the exercise session, to feel they are being comfortably challenged and that the exercise is not out of their control, to perceive they are gaining benefit from the exercise, and to be able to dissociate from the symptoms of the exercise. Qualitative data from this study suggest some overlap with some of these themes, with the young adolescents associating confidence, control of the exercise intensity, and the absence of negative physiological cues with positive affective responses.

General Discussion

The rebound phenomenon, which has been consistently identified in the affect literature in adult populations (e.g., Hall, Ekkekakis, & Petruzzello, 2002; Rose & Parfitt, 2007, Welch et al., 2007), was present in both the patterning of FS responses of the young adolescents and in their narratives. However, the rebound effect was slower, perhaps as a result of the reported negative physiological sensations that
continued after the exercise had finished. The participants in this study had stated a preference and tolerance for low-intensity exercise, so the adverse responses to strenuous exercise are understandable and not unexpected. Of interest are the reasons focused upon for the negative responses. Participants consistently described uncomfortable physical sensations of hurt, aches, and pains in the muscles and also reported sweating, feeling hot, and breathing more heavily. The markedly slower rebound at the end of exercise in the above-VT intensity conditions supports Ekkekakis’s (2003) suggestion that interoceptive cues will take longer to dissipate due to the intensity of the exercise stimulus. This may be even more relevant to a low-active population, or inexperienced exercisers, who are not accustomed to the sensations of physical exertion. Petruzzello et al. (1997) suggest that in line with affective habituation or tolerance (Solomon, 1980, 1991), the amount of previous exposure to the exercise stimulus will influence the pattern of affective responses. Specifically, individuals who do not regularly engage in exercise will experience less positive affect immediately following exercise and the response will be smaller in magnitude and shorter in duration.

The most consistent pleasurable experiences, according to the FS data, were recorded in the self-selected and below-VT conditions. Applying hedonic theory would suggest that these intensities should positively influence future behavioral decisions. Fredrickson (2000) states that “people’s past and ongoing affective experiences guide their decisions about the future” (p. 577); this quote highlights the potential role of affective memory on future exercise behavior. Fredrickson and Kahneman (1993) suggest that affective memory is influenced by two specific episodes—the peak and the end—and the phenomenon is termed the peak-end rule. It is proposed that it is our past experience of exercise that will affect our judgment on whether to do it again. Our recall of the experience is said to be made up of two critical moments: the peak of the experience (whether it is pleasant or unpleasant) and the end of the experience (whether it is pleasant or unpleasant). It is suggested that the overall experience and the duration of the experience are not used in the judgment. In this way, the participants would remember the most unpleasant moment of the above-VT intensity exercise test and the end when they were still feeling bad. In contrast, in the self-selected intensity, at-VT, or below-VT intensity conditions, participants would remember feeling good during the exercise and feeling good when it ended.

It has been suggested that people do not always maximize pleasant experiences and minimize unpleasant ones (Parrott, 1993), nor do they always repeat experiences they have enjoyed and always avoid experiences they have found aversive. It would seem sensible to structure exercise experiences to be as pleasurable as possible. With low-active adolescents, the recommendation would therefore be to prescribe intensities below VT, or allow the individuals to self-select the intensity themselves.

In all the narratives, the young adolescents regularly associated their affective responses with physiological cues generated from the exercise, whether those physiological cues were present or absent. Participants particularly described negative physiological cues (e.g., aches and pains) in the above-VT story and to some extent in the at-VT story. The participants associated these cues with declines in their feeling states. However, the young adolescents did not seem to reflect on these cues and try to make sense of them; they just reported responding to the experience of
feeling them. This is in contrast to sedentary women (Rose & Parfitt, 2007), who linked these cues with the potential benefits of exercise.

In considering the importance of a positive exercise experience for determining future exercise adherence, the emphasis on individual preferences and the active involvement of the participant in selecting the exercise intensity could be key (King & Martin, 1993, Parfitt et al., 2006; Rejeski, 1994). In the self-selected exercise intensity, where participants were in control of their intensity, the most positive (quantitative) FS responses were reported. Further, the qualitative narrative illustrates how participants report modifying the self-selected intensity level to avoid experiencing negative physiological cues. Positive affective valence responses experienced at this intensity, the positive exercise experience gained, and the outcome expectancy of potential positive experiences in the future could lead to greater physical activity participation through enhanced self-efficacy (Williams, 2010) and the development of more self-determined forms of motivation (Ryan & Deci, 2000). More autonomous forms of behavior have been shown to result in more positive affective experiences and greater levels of enjoyment (Vallerand & Rousseau, 2001). Interestingly, research with a similar age group (Schneider & Graham, 2009) suggested that adolescents with a preference for lower intensity exercise might find all intensities of exercise aversive, even lower intensities. The results of this study suggest this assertion may not be accurate. In the below-VT intensity of this study, young adolescents reported feelings of enjoyment and competency. At this age, perhaps the focus should be on encouraging adolescents to enjoy taking part in physical activity and exercise and facilitating mastery and competence experiences. This is an age when young adolescents are searching for a stable identity and developing a stable self-concept (Harter, 1978). It could be argued to be a crucial time to develop competency feelings about exercise ability. Therefore, creating positive exercise experiences should be a main priority for any exercise professional prescribing exercise for young adolescents.

This study has used a mixed methodology design, which has led to new detail regarding the patterning of affective responses, and presents possible cognitive and physiological factors that young adolescents associate with affective response during and after exercise at prescribed and self-selected exercise intensities. It should be noted that testing took place in a laboratory environment, which means that the external validity of the results may have been compromised. Generalizing the findings of this study may also be limited by the characteristics of the population and the exercise mode (cycle ergometer) and the results should be considered within the demographics of the participants. Lastly, these qualitative data represent a nomothetic view—the majority voice at each intensity level. The data do not represent every view expressed by the participants who took part in the study. It would be of interest to report details of those participants who did not follow the mean patterning of FS responses or who would tell a different story.

These data provide one of the first insights into understanding affective responses of young low-active adolescents to exercise. During these formative years, health and physical activity professionals should structure the environment to ensure that adolescents are encouraged, via a variety of processes, to initiate and then maintain a physically active lifestyle into adulthood. Focusing on creating positive affective experiences may be a way of supporting this objective.
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References


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