Banjy: fun to move and play for kids around 12 years of age

H. Ravelli\textsuperscript{a}, M. van Rooijen\textsuperscript{b}, T. Jongert\textsuperscript{c}, H. de Voogd-Claessen\textsuperscript{d}, J. Hoyng\textsuperscript{e}, M. E. van der Zande\textsuperscript{f}, D.E. Karremant

\textsuperscript{a}Creazi, Sint Jacobstraat 19, 1811BN Alkmaar, The Netherlands
\textsuperscript{b}Sport en Beweegplein, Sportcomplex Eindhoven-Noord, Vijfkaplaan 12, 5624 EB Eindhoven, The Netherlands
\textsuperscript{c}De Haagse Hogeschool, Johanna Westerdijkstraat 75, 2521 EN Den Haag, The Netherlands
\textsuperscript{d}Delft University of Technology, Postbus 5, 2600 AA Delft, The Netherlands
\textsuperscript{e}Nederlands Institute voor Sport en Bewegen, Postbus 64, 6720 AB Bennekom, The Netherlands
\textsuperscript{f}Innosport, Papendallalaan 7, Arnhem 6816 VD, The Netherlands

Abstract

Stimulating the physical condition of children in a playful way is the main goal of the Banjy. Crossover product combining a traditional elliptical trainer and a bicycle. This means that it has all the benefits of training almost all muscles combined with the playful and functional possibilities of a bike. Early 2009 innovation support from InnoSportNL and partners like the Haagse Hogeschool (HHS), Delft University of Technology (TUD) and Netherlands Institute for Sport and Physical Activity (NISB) came available to Creazi. This paper is mainly about what variation of research that is done to develop this idea to a fully developed product.

Keywords: kids, fitness, play, outside, bicycle, physical condition

1. Introduction

How do we get our children to play outdoors again? Is it possible to develop a toy or new bike that offers enough joy and challenge for a longer period? These questions were the starting point of the product development which is described below which is called Banjy. Early 2009 one challenge, the continuous worldwide growth over the last five years in the amount of children that have obesity, triggered the idea to improve their physical condition by this new attractive toy. This idea was warmly welcomed by InnoSportNL. In May 2009 the project plan started, consisting of three major project phases:

- Proof of the concept

\textsuperscript{a}Corresponding author. Tel.: +31654393556
Email address: hanco@creazi.nl (H. Ravelli)
To limit ambitions, the target user group for the concept was fixed to one age group of children: up to 12 years (8-12). In the Netherlands at the age of 12 kids change from primary school to secondary school which is just before the start of their puberty. The main ambition of the project was to create an effective and attractive product for improvement of the physical condition (Figure 1). For Creazi, the goals are to create a product (portfolio) with the potential (worldwide) license agreement.

2. Methods

Proof of the concept was primarily done by interaction research: first was to prove the effect of Banjy on the physical condition of the user. Secondly, if this effect proved to be positive, can this be a product that children like to play with? The technique used for the exercise tests was to measure the use of oxygen and variation in heart rates, before, during and after the test runs (Figure 2). This was carried out by the Haagse Hogeschool.
3. Methods

To proof of the attractiveness of the concept research was done through observed monitoring of free use (103 children) combined with interviews (30 children) at a playground. Children came voluntary and unprepared to play. Another part of the research with the Banjy was to lend the Banjy test models to families for two or three weeks (5 families, 15 children). In this case the children received a diary and a discussion and interview was held at the end of the lending period. Next to the practical test with the prototypes three other kinds of research were used. One was guided creativity sessions with children in a classroom environment to find out their ideas about a new vehicle (total amount of 118 children). A Banjy-Hyves website was used to keep in contact with the children. And complementary research was finding literature, contacting experts and researching the playing preferences of children nowadays (questionnaire; 118 children). To analyse the data two different methods were used. A frequency -severity diagram [1] and clustering of statement cards that led to a factor map. This was all performed by a graduate student of the TUD.

After proving the concept a GO was received for the actual product development. Goal is to design an attractive product for the targeted user group. Primarily design methods of the TUD faculty Industrial Design are used such as Brainstorming in a group and AIDA (Analysis of Interconnected Decision Areas) [2], which is very suitable to solve technical/mechanical problems. The ideas will be judged with the criteria found in all the previous mentioned research. Finally one concept for a new vehicle will be detailed. Another important source of information in the design process is done through studying relevant patents and concurrent products. The designed concepts are then tested again on energetic and attractiveness values. (End of March 2010 with +/- 10 kids) Evaluating these results the best Banjy concept will be materialized into a prototype with ready to sell qualities.

4. Results

4.1. Research on physical condition

When four test models of the Banjy were produced, testing started. The testing of Banjy indicated MET values for use of the Banjy prototypes: 8.2 and Kcal/minute 5.4 (Table 1). These are values that are comparable to sports like football, hockey and basketball (Table 2). Both values are based on tests with first time Banjy users (n=16). More user experience will probably lead to lower values. At the same time: more experience will lead to more playful use which will increase these values again. These values correspond with the guideline of the Dutch ministry of health that advises: 2x 30 minutes of average exercise per day/ per child.

4.2. Research on interaction

Various types of enquiries with kids that played with the Banjy resulted in a positive feeling on its potential. Most important conclusion out of these enquiries was that the Banjy provided far more pleasure than just one occasion, because first children have to learn how to ride, but afterwards they use the Banjy in their play.

The severity/frequency diagram used to clarify the problem areas. As seen in Figure 3 the yellow problems (about storing) are very important to solve. The factor map shows the themes and factors that connect the themes (Figure 3). Most important findings in the research were
Table 1: Overview from effort values in MET

<table>
<thead>
<tr>
<th>pers.</th>
<th>(m/v)</th>
<th>age</th>
<th>VO2 (ml/kg/min)</th>
<th>MET Cortex</th>
<th>RER</th>
<th>Hf rest</th>
<th>Hf avg</th>
<th>% Hf max</th>
<th>max Energy use (KJ/min)</th>
<th>(Kcal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V</td>
<td>9</td>
<td>20,8</td>
<td>5,9</td>
<td>0,96</td>
<td>70</td>
<td>126</td>
<td>65</td>
<td>18,8</td>
<td>4,5</td>
</tr>
<tr>
<td>2</td>
<td>V</td>
<td>11</td>
<td>20,9</td>
<td>6</td>
<td>0,9</td>
<td>102</td>
<td>128</td>
<td>66</td>
<td>20,2</td>
<td>4,8</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>10</td>
<td>25,5</td>
<td>7,3</td>
<td>0,91</td>
<td>92</td>
<td>131</td>
<td>68</td>
<td>23,7</td>
<td>5,7</td>
</tr>
<tr>
<td>4</td>
<td>V</td>
<td>10</td>
<td>21,2</td>
<td>6</td>
<td>0,95</td>
<td>99</td>
<td>140</td>
<td>73</td>
<td>15,4</td>
<td>3,7</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
<td>11</td>
<td>24,2</td>
<td>6,9</td>
<td>0,9</td>
<td>94</td>
<td>145</td>
<td>75</td>
<td>16,2</td>
<td>3,9</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>12</td>
<td>27,6</td>
<td>7,9</td>
<td>0,88</td>
<td>91</td>
<td>154</td>
<td>80</td>
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<tr>
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<td>M</td>
<td>10</td>
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<td>12,4</td>
<td>1,03</td>
<td>104</td>
<td>173</td>
<td>90</td>
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<tr>
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<td>V</td>
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<td>8</td>
<td>0,92</td>
<td>113</td>
<td>164</td>
<td>85</td>
<td>22,1</td>
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<td>10</td>
<td>V</td>
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<td>159</td>
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<td>V</td>
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<td>86</td>
<td>161</td>
<td>83</td>
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<td>6,4</td>
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<td>Avg</td>
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<td></td>
<td>29,3</td>
<td>8,3</td>
<td>0,94</td>
<td>95</td>
<td>150</td>
<td>78</td>
<td>22,6</td>
<td>5,4</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>7,7</td>
<td>2,2</td>
<td>0,04</td>
<td>12,1</td>
<td>16</td>
<td>8,4</td>
<td>5,2</td>
<td>1,2</td>
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</tbody>
</table>

Table 2: Activity and MET value

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>MET-value</th>
<th>Kcal per min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest or daily activities</td>
<td>1.0</td>
<td>0,9</td>
</tr>
<tr>
<td>TV, typing, gaming</td>
<td>2.0</td>
<td>1,0</td>
</tr>
<tr>
<td>Walk 5 km/hr, playing outside</td>
<td>4.0</td>
<td>2,4</td>
</tr>
<tr>
<td>Biking 16 km/h</td>
<td>6.5</td>
<td>3,6</td>
</tr>
<tr>
<td>Swimming (crawl) 1 km/h</td>
<td>5.0</td>
<td>5,4</td>
</tr>
<tr>
<td>Jogging - running</td>
<td>8.0</td>
<td>5,6</td>
</tr>
<tr>
<td>Banjy</td>
<td><strong>8.3</strong></td>
<td><strong>5.4</strong></td>
</tr>
</tbody>
</table>

(based on the extra strong, heavy and big test models:

**Moving and steering**
- Children do like the way of moving with using arms and legs and the unconventional way of steering

**Time to learn to ride**
- 89% of the children can ride the Banjy within 10 minutes
- Children younger than 8 years old have more problems riding the Banjy than older children
- Boys are less careful than girls

**Playing**
- More than half of the children like to play active outside, the Banjy fits for this.
- Playing with the Banjy is enervating
- Playing with the Banjy is challenging
- Children play together with the Banjy (racing or together on one Banjy)

**Traffic**
- Dangerous in traffic because of steering limitations
- To less functionality to carry persons or products
Figure 3: (a) Severity frequency diagram, (b) Factor Map

Sport
- Very well for condition
- Others can sport with it, but I don’t
- Link to elliptical trainer

Parents
- Banjy is too big to store
- Because storing is difficult children don’t want to play for short amount of time
- Expectation Banjy will be very expensive
- Parent buy the Banjy, because children of 8-12 years do not have that amount of money to spend

Appearance
- On pictures Banjy is dull
- Banjy is like a bike for disabled persons

Problems
- Banjy is too big to store
- Dangerous situations in traffic

After eliminating the statements due to the extra strong, heavy and big test models, the outcome of the interaction research is that children aged 8-12 year like to play with the way of moving with both arms and legs. Because riding the Banjy is difficult in the beginning, children are driven to learn. Within 10 minutes 89% of the children can control the Banjy. This seems too easy to create a challenge at the long term. The Banjy should be a toy encouraging children to play more active, and the Banjy can help to reach the ”Nederlandse Norm Gezond Bewegen” (60 minutes of active movement per day). Children do see the comparison with the elliptical trainer, but don’t want to use the Banjy for sports or fitness. Of course it is very well for condition and coordination, but children don’t see themselves sporting with the Banjy, but in their opinion others can (Figure 4).

5. Future

After these positive results, a GO for the next project step was evident. This is the actual design phase, which consists of the product design in every detail. It started November 2009
and will be finished end of May 2010. Before starting the actual design (executed by a graduate master student of the TUDelft university) a list of 18 possible physical product adjustments was still to be tested to figure out what the optimal configuration for the product will be. This testing took place in November till February. It consisted of changing several parts (or combination of parts) then short practical testing, documenting the differences in ergonomics and mechanics and on to the next item on the list. End of March all testing was done, including a new research on the physical condition effect with new prototypes. After integrating these last results into the final design the expectations the Banjy can now be optimized in size, weight and handling. The results at the moment (March 2010) are 50% reduction in size and weight compared to the first test models. Handling is also improved dramatically: now the learning curve is about 5 times longer and comparable to a skateboard. End of June the final product development and final tests are finished. Just in time for the upcoming ISEA conference!

References
