

Designing a Music-controlled Running Application: a Sports Science and Psychological Perspective

For **casual runners**, music may act as a **motivator** and **distractor of physical strain**.

Interesting phenomenon: People instinctively sync their pace with the music's tempo – **they run to the beat**.

Sensing technology enables **adapting music to a runner's situational requirements in real-time**
→ runners will adapt automatically



Overall goal: Create a **music-controlled app** that
(i) increases casual runners' motivation and (ii) controls training.

This work: (i) Synthesizing findings from **sports science** and **psychology**;
(ii) setting up requirements

	Category	Training requirements and advice	Technical solution opportunities
Using music to indicate to the runner the actions he or she should take	Intensity control	Can be controlled by having runner adapting step frequency (pace) synchronously to the bpm of music <ul style="list-style-type: none"> Category 1: 120-130 bpm, low sound volume Category 2: 135-145 bpm, medium sound volume Category 3: 145-155 bpm, high sound volume 	<ul style="list-style-type: none"> Select a piece of music that matches the pace that falls in the respective category Slow down/speed up music to reach bpm Music is generated on the fly with required bpm
	Heart rate monitoring	Optimal training zones (according to Karvonen): $(\text{maximum heart rate} - \text{resting heart rate}) * \text{factor} + \text{resting heart rate}$ with the following factors: <ul style="list-style-type: none"> 0.5 for warm-up and cool-down (= category 1); 0.6 for extensive running (= category 2); 0.8 for intensive running (= category 3). Raise by 5 bpm every 20 min (cardiovascular drift)	<ul style="list-style-type: none"> Linkage of heart rate monitoring hardware with music application e.g., via Bluetooth After every 20 min adjusting/selecting music pieces by 5 bpm increase
	Training method	2 different kinds of training methods (user's choice): <ul style="list-style-type: none"> Continuous method: e.g., 5 min warm-up, 20 min continuous running, 5 min cool-down Interval method: e.g., 5 min warm-up, 3x4 min intervals with 4 min interval pause, 5 min cool-down 	<ul style="list-style-type: none"> Continuous method: sequence of music of categories 1, 2, and 3 depending on heart rate and pace Interval method: as for continuous method; additionally music stops for 4 min interval pause; alternatively, music without beat
Successful training regime	Performance diagnostics	<ul style="list-style-type: none"> For start: 2,400 m running test; to be repeated every 6 weeks for a performance review The (expected) improvement of performance has a positive effect on motivation 	<ul style="list-style-type: none"> Guiding user through 2,400 m run test Documentation of performance progress e.g., GPS for measurement of 2,400 m
	Training volume	<ul style="list-style-type: none"> For 2 weeks: 1.5 hours/week (3x30 min) Increased by 10% every 2nd week until a training volume of 3 hours/week (3x1 hour) is reached 	<ul style="list-style-type: none"> Calendar for planning training sessions Synchronization with calendar applications
	Duration of training	<ul style="list-style-type: none"> Initial training session 30 min. Increased by 10% every 2nd week until training volume of 3 hours/week (3x1 hour) is reached 	<ul style="list-style-type: none"> Length of the playlist controls training duration Audio feedback indicating end of training
Music preference	Motivational aspects of music	Music is motivating if it: <ul style="list-style-type: none"> Matches the runner's taste Contains lyrics (if any) that are pleasant Evokes positive associations Is selected by the runner him or herself 	<ul style="list-style-type: none"> Use existing music on a runner's mobile device Analyzing lyrics; retrieving lyrics e.g. by using the Musixmatch API Alternatively, provision of music content that is already approved concerning its lyrics Analysis of harmonies e.g., by Brunel Music Rating Inventory-2

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