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Impact of active and passive social facilitation on self-paced endurance and sprint exercise: encouragement augments performance and motivation to exercise

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ABSTRACT

Objective The positive effect of an audience on performance is anecdotally well known, but the impact of such social facilitation to both performance and the motivation to exercise have not been thoroughly explored. The aim of this study was therefore to investigate verbal encouragement as a means to promote positive behavioural adherence to exercise and augmented performance.

Methods Twelve untrained but active individuals (seven female), age 24±3 years participated in this study. Exercise conditions with external verbal encouragement (EVE) and without external verbal encouragement (WEVE) were compared in both endurance (20 min) and sprint (2 × 30 s Wingate) cycling tasks in a randomised crossover design. Results were analysed by separate 2 (EVE/WEVE) × 2 (sprint/endurance) within-subjects analyses of variance for each dependent variable. Statistical significance was set at p≤0.05.

Results EVE resulted in a significant increase, $F_{(1,11)}$=15.37, p=0.002, η_p^2=0.58 in the average power generated by participants in each exercise bout on the cycle ergometer. EVE also had a significant effect on reported motivation to exercise the next day, $F_{(1,11)}$=5.5, p=0.04, η_p^2 =0.33, which did not differ between type of exercise.

Conclusion External encouragement in both sprint and endurance activities resulted in large improvements in performance and motivation to continue an exercise regimen the next day, which has important implications for health, adherence and maximising physical performance using a practical intervention.

What are the new findings?

- Verbal encouragement increases the motivation to exercise the next day and hence prolonged adherence to exercise, an important finding relevant to promoting an active lifestyle across world population.
- Social facilitation in the form of external verbal encouragement is a powerful aid to performance.
- This is the first controlled study exploring social facilitation of an encouraging environment in relation to aiding self-regulatory exercise processes. This may aid exercise adherence, promote healthy behaviours and potentially support performance.

INTRODUCTION

It is well known that in situations where individuals are able to exert self-control over a particular action they are more likely to enjoy the experience, develop sustainable exercise behaviours and achieve success in task execution.[1] However, while there are many benefits to self-regulatory exercise, it has also been observed that self-regulated training loads tend to diminish when exercise is performed in isolation, particularly among novice and recreational exercisers.[2 3] A recent study demonstrated this could be improved by the presence of a spotter in resistance training,[4] probably aiding both confidence in safety issues and motivation to complete the task. It seems likely that similar social facilitation could be translatable to a range of exercise situations where motivation and reassurance are influential. The positive effect of having an audience observing performance is anecdotally well known in team sports in the form of the home team advantage.[5] However, it is surprising such social facilitation of an encouraging environment has not yet been thoroughly explored in relation to aiding self-regulatory exercise processes and yet this may aid exercise adherence, promote healthy behaviours and potentially aid performance.

While self-regulation is a relatively common technique in the regimen of endurance athletes and increasingly included in talent development programme to select and optimally prepare youth athletes for competition,[6] empirical data regarding enhancement or facilitation of self-regulatory performance in the context of training and exercise are relatively scarce. This is unusual as exercising without peer support is such a common form of exercising. External stimuli such as music have occasionally been shown to be effective in augmenting performance in self-regulated activities such as peak power in response to high intensity cycling[7] although this has not been demonstrated consistently between laboratories and among different population groups.[8] Racing against opponents has been reported as another potential powerful external stimulus that could enhance performance of experienced athletes,[9] improving performance[10] while simultaneously lowering the perceived effort of the exercise task.[11] For inexperienced and recreational exercisers in particular, encouragement from a fellow exerciser, coach, friend or personal trainer might be the most promising way to readily facilitate and enhance self-regulatory exercise and consequently training adherence. With increasing focus on active and healthy lifestyles, this group of exercisers has become increasingly large and there is a need to explore ways to guide them towards optimising their performance and remain engaged in training sessions.[1]

Though offering encouragement while training appears a promising means to optimise self-regulatory training output and adherence, there is limited empirical data available. As experienced athletes have well developed exercise pacing strategies that enable them to control sensations of fatigue and improve exercise performance, they usually are very capable of engaging in self-regulatory training exercises.[12] Inexperienced exercisers, however, often do not perform maximally when left to self-regulate[1] and are less likely to be able to pace themselves effectively during exercise, which can lead to premature sensations of fatigue and less enjoyment, which in turn, leads to poor exercise performance.[12–14] Therefore, untrained and recreationally active people are likely to work harder in the presence of a social facilitator than when performing in isolation, although this may also lead to overestimations of physical conditioning and inaccuracies of pacing.[9] However, it seems likely those who do not engage in structured training exercises might benefit most from social facilitation when exercising in order to improve training output and training adherence.

When it comes to modifying health behaviours such as exercise and increasing motivation to engage in these behaviours, encouraging feedback is a powerful reinforcer.[15] This can be quite different to real-time feedback on technical performance which can be distracting and demotivating if perceived negatively.[16] However, when non-technical supportive feedback is perceived positively, it often enhances the athletes' perceptions of competence and autonomy, both of which mediate their level of motivation.[17]

The purpose of this study was to examine whether passive (silent) or active (verbal encouragement) results in meaningful social facilitation of performance in untrained adults across both endurance (endurance) and sprint (power) training. By comparing impacts to endurance and sprint conditions, it might also be possible to ascertain whether encouragement is more or less effective in modify different types of exercises.. Therefore, the current study examines whether standardised verbal encouragement can improve physical performance compared with passive, silent social facilitation while at the same time maintaining or even improving levels of psychological well-being, fatigue, pain and motivation.

METHODOLOGY

Experimental design

The effect of external verbal encouragement (EVE) on indicators of physical performance (power), Rate of Perceived Exertion (RPE), subjective well-being and distress (Subjective Exercise Experience Scale (SEES)), fatigue and motivation to exercise was examined in two types of exercise (sprint and endurance) using a 2×2 within subjects (cross-over), factorial experimental design. All participants undertook a prestudy familiarisation session comprising the sprint and endurance tasks and thereafter undertook four separate exercise sessions performed in a random order. The familiarisation trials mirrored the experimental conditions to minimise the possibility of uncertainty in protocol operation. Each session participants undertook either sprint or endurance exercise challenges with EVE or without EVE (WEVE). The same social facilitator was present for all trials, but was either passive (silent and not visible) (the WEVE trials) or active, visible and verbally encouraging (the EVE trials). The order of trials was randomised to avoid the possibility of systematic learning effects influencing performance outcomes.

Participants

The sample consisted of 12 individuals (7 female, 5 male), mean±SD: age 24±3 years, height 1.66±0.78 m, weight 66.5±17.5 kg, $\dot{V}O_2$ max 37.5±6.7 ml.kg.min^{-1}. Participants all identified as untrained, recreationally active (ie, engaging in occasional exercise activities), but did not engage in structured training exercise. On recruitment, participants were given written instructions describing all procedures related to the study and all provided informed consent prior to commencement. To identify any medical or psychological conditions which may have impeded the participants' ability to exercise safely, participants were screened prior to the first exercise session with a prescreening medical history questionnaire. No physical or psychological impediments to exercise were recorded. Base-level fitness was assessed with the multistage fitness test for the purpose of estimating maximal oxygen uptake.

Procedures

Endurance exercise task

The endurance exercise task consisted of a 20 min cycle on a fixed ergometer (VeloTron and Velotron Coaching Software, Racermate, USA) and participants' were instructed to sustain the highest power output they could manage across 20 min. An additional 3 min cycle warmup and 3 min cycle cool-down was conducted before and after the 20 min exercise bout.

Sprint exercise task

The sprint task consisted of two bouts of the 30 s Wingate Sprint Cycling Test (WAnT) (VeloTron and Wingate Testing Software, Racermate, USA). Each participant started the protocol with a 5 min self-regulated cycle warmup at RPE 11 (light), followed by the first 30 s Wingate bout, then a 5 min self-regulated active recovery,[18] followed by the second Wingate bout. The protocol concluded with a 5 min cycle cool-down (RPE 7; Extremely light).

Average and peak power (watts) was recorded for the endurance and sprint tasks. Heart rate (RS400, Polar Elektro, Finland) was collected at 5 s intervals throughout.

All exercise sessions were conducted in the afternoon, between 13:00 and 17:00 hours. Each participant was given the same instructions by the researcher on equipment operation, exercise session duration and safety precautions, and the importance of giving maximal voluntary effort in all exercise bouts was stressed.

A small clock was placed in front of participants so that time was displayed across all exercise conditions. Participants were first fitted with the heart rate (HR) monitor before the start of each exercise bout. The order of each test sequence was randomised between participants. Each participant completed all testing sessions over a 6-week period with a minimum 48 hours recovery period between visits to the laboratory.

Subjective psychological measures

Subjective perceived effort was measured using the 6–20 Borg Rating of Perceived Exertion (RPE) Scale. All reflective RPE assessments were conducted immediately at the conclusion of each exercise bout.

Participants were also asked to rate their subjective level of pain/discomfort on a 1–10 scale with (0) indicating *no pain/discomfort*, (5) *moderate pain/discomfort* and (10) *extreme pain/discomfort*. A second scale was used to measure participants' motivation to exercise on the following day with (0) indicating *not motivated*, (5) *somewhat motivated* and (10) *extremely motivated*. The pain/discomfort scale was administered immediately at the end of each exercise bout, and the motivation to exercise scale was conducted at conclusion of each exercise condition.

The SEES[19] assessed positive or negative well-being as a response to exercise participation. This scale is a 12-item inventory with three dimensions: Positive Well-being (PWB), Psychological Distress (PD) and Fatigue (FAT). Participants responded on a 7-point Likert scale ranging from *not at all* (1) *to very much so* (7), with *moderate so* at (4). The SEES was administered at the conclusion of each exercise condition.

Table 1 Frequency of encouragement delivery from the Personal Trainer across endurance and sprint tasks

Time	Motivational feedback
Encouragement endurance	
Start 5 min 7 min 30 s 10 min 17 min 30 s 19 min 50 s (count down last 3 s) 20 min (finish)	Motivation (ie, 'you can do it, keep going, you're doing great, you're nearly finished', etc) Positive reinforcement (ie, 'good riding technique, pace, power, speed, breathing', etc)
Encouragement sprint	
Start 15 s (half way) 10 s (count down last 3 s) 5 s 3 s 1 s 30 s (finish)	Motivation (ie, 'you can do it, keep going, you're doing great, you're nearly finished', etc) Positive reinforcement (ie, 'good riding technique, pace, power, speed, breathing', etc)

External verbal encouragement (EVE) condition

During the encouragement conditions, the same female social facilitator remained next to the exercising participant for the duration of the bouts. Positively reinforcing statements were used to aid performance (ie, 'that's great speed, keep it up' or 'that's good power'). Encouragement on time elapsed was phrased positively (ie, 'you're half way already' and 'only 10 s to go'), while general motivating statements were used intermittingly throughout the bouts. The schedule of encouragement delivery between tasks was devised to provide more frequent motivation (encouragement) during the last 5 mins of the endurance bout, and the last 10 s of their sprint bout, to elicit maximal performance and completion of exercise bout (table 1, for timing and examples of feedback given). Statement frequency and spacing of comments was scripted to be consistent across participants.

Without external verbal encouragement (WEVE) condition

During the sprint and endurance WEVE exercise bouts, the social facilitator remained seated and silent approximately five metres from the participant and out of view. Participants were only given basic instructions on how to operate the cycle ergometer, and when the exercise bout commenced and finished.

Statistical analyses

For power, cadence, heart rate and subjective psychological measures, RPE, pain/discomfort, motivation, fatigue and psychological well-being (positive and negative), separate 2 (EVE/WEVE) × 2 (Sprint/Endurance) within-subjects analyses of variance (ANOVA) were conducted for each dependent variable. For power, cadence and heart rate both the mean over the whole exercise bout and the peak level reached in each exercise bout were

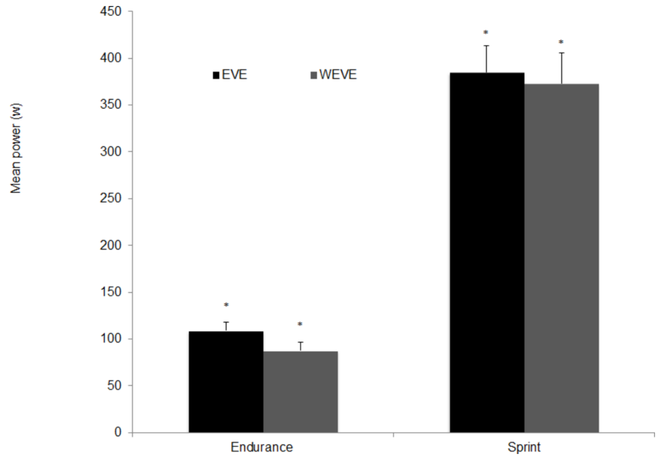

Figure 1 Mean power (in Watts) in each of the four exercise bouts. Error bars show SE of the Mean (SEM). *Significant difference, p<0.01. EVE, external verbal encouragement condition; WEVE, without external verbal encouragement condition.

reported. All data met the assumptions of within-subjects ANOVA. Results were considered statistically significant if p≤0.05.

RESULTS

Exercise performance

The encouragement provided by the social facilitator in EVE resulted in a significant increase (main effect of encouragement) $F_{(1,11)}$=15.37, p=0.002, η_p^2=0.58, in the average power generated by participants in each exercise bout on the cycle ergometer (figure 1) relative to the WEVE condition. The interaction between EVE and type of exercise (endurance and sprint) was not significant $F_{(1,11)}$=0.92, p=0.36, η_p^2=0.077. Thus, EVE had similar effects on mean power generated by the participants in both endurance and sprint contexts.

Table 2 Raw units of outcome measures (mean±SD)

	Endurance		Sprint	
	EVE	**WEVE**	**EVE**	**WEVE**
Average power (W)	109±32	88±28	385±99	373±111
Distance (m)	1124±146	1064±155	N/A	N/A
Avg peak power (W)	N/A	N/A	581±225	550±219
Peak power (W)	N/A	N/A	606±227	572±230
Average HR (bpm)	158±9	148±15	151±10	146±12
Peak HR (bpm)	N/A	N/A	182±10	180±10
RPE (units)	16±3	13±2	17±1	15±1

EVE, external verbal encouragement condition; HR, heart rate; RPE, Rate of Perceived Exertion; WEVE, without external verbal encouragement condition.

A similar result was found for peak power (table 2), with the encouragements of the social facilitator resulting in a significant increase in peak power output, $F_{(1,11)}$=5.36, p=0.041, η_p^2 =0.33, while the interaction between EVE and type of exercise (endurance and sprint) was not significant $F_{(1,11)}$=1.15, p=0.305, η_p^2=0.095.

A significant elevation of mean HR was observed in the EVE conditions relative to the WEVE conditions, $F_{(1,11)}$=4.9, p=0.049, η_p^2 =0.31, but not the peak HR, $F_{(1,11)}$=3.97, p=0.072, η_p^2=0.27. This effect on mean HR was however modest and very variable (endurance; 10±9 bpm, sprint; 6±6 bpm). There was no significant difference between endurance and sprint mean HR, $F_{(1,11)}$=2.74, p=0.13, η_p^2 =0.199 or peak HR, $F_{(1,11)}$=0.09, p=0.77, η_p^2 =0.85. Nor were either interaction statistically significant, mean HR $F_{(1,11)}$=0.28, p=0.61, η_p^2=0.024, peak HR $F_{(1,11)}$=0.06, p=0.82, η_p^2=0.005. Participants receiving encouragement experienced significantly elevated average heart rate compared with those that were not receiving encouragement (endurance; 10±9 bpm, sprint; 6±6 bpm) (p<0.05).

Subjective psychological measures of exercise

Borg Rating of Perceived Exertion (RPE)

EVE from the social facilitator significantly increased participants' rated subjective exertion (RPE), $F_{(1,11)}$=26.7, p=0.001, η_p^2 =0.71. Participants also perceived sprint exercise as significantly more difficult in the EVE condition, $F_{(1,11)}$=10.7, p=0.008, η_p^2 =0.49. In addition, there was a significant interaction between EVE and type of exercise, more pronounced in endurance activity $F_{(1,11)}$=9.02, p=0.012, η_p^2=0.45.

EVE resulted in a significant increase in reported motivation to exercise the next day, $F_{(1,11)}$=5.5, p=0.04, η_p^2 =0.33. However, there was no interaction, $F_{(1,11)}$=0.48, p=0.504, η_p^2=0.04, between social facilitation conditions and exercise type which suggests this is a general effect of EVE and is not specific to endurance or sprint exercise (figure 2).

Fatigue

The encouragement provided by the social facilitator did not affect participants' overall subjective level of fatigue, $F_{(1,11)}$=0.072, p=0.793, η_p^2=0.007. However, the interaction between EVE and exercise was significant $F_{(1,11)}$=5.93, p=0.033, η_p^2=0.350, indicating that EVE increased perceived fatigue compared with WEVE.

No significant effect of EVE was observed on psychological well-being (positive), $F_{(1,11)}$=0.02, p=0.88, η_p^2=0.002 or psychological discomfort (negative), $F_{(1,11)}$=0.29, p=0.6, η_p^2=0.03. There were also no significant main effects of type of exercise or any significant interactions. The % change and effect sizes of dependent variables were also assessed in this study for further evaluation. This supported earlier observations of changes to RPE and average power outputs across both sprint and endurance activities (table 3).

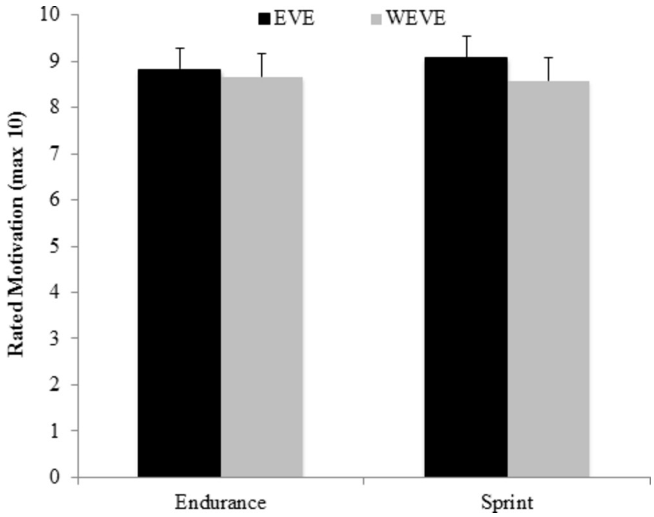

Figure 2 Subjective motivation to exercise the next day (0=not motivated to 10=extremely motivated). SEM indicated by the error bars. EVE, external verbal encouragement condition; WEVE, without external verbal encouragement condition.

DISCUSSION

The main finding of this study was that the presence of a social facilitator providing verbal encouragement resulted in improved performances in both endurance and sprint cycling tasks compared with acting as a passive observer. To our knowledge, this provides the first controlled study confirming that a positive environment of active encouragement improves exercise performance in recreationally active people across different exercise tasks. This might help to maintain or even increase future motivation[1] to engage in regular exercise and obtain the experience required to develop effective self-regulatory behaviour for improved performance, depending on the motivation of the exerciser who may simply desire to feel better emotionally after a workout rather than seeking a performance gain.[20] These findings could also be applicable to a number of different sporting situations, such as team games that rely on both endurance and sprint energy resources. In these sports, a positive, supportive environment might be more conducive to better performance than passive observation alone as is seen with the influence of a crowd effect.[21 22]

Table 3 Impact of social facilitation on performance (mean±95% CL)

	Change (raw units)	% Change	ES	P values
Sprint				
Average power (W)	21±8	26±13	0.70	<0.001
Distance (m)	60±86	7±8	0.40	0.15
Average HR (bpm)	10±9	8±7	0.82	0.032
RPE (units)	2±1	13±3	1.11	<0.001
Endurance				
Average power (W)	12±18	5±5	0.11	0.163
Avg peak power (W)	31±35	7±7	0.14	0.076
Peak power (W)	33±46	8±9	0.15	0.099
Average HR (bpm)	6±6	4±5	0.52	0.169
Peak HR (bpm)	3±9	2±5	0.26	0.276
RPE (units)	3±4	15±4	0.42	0.011
Fatigue (unit)	2.0±3.2	12±15	0.13	0.198

ES, effect size; HR, heart rate; RPE, Rate of Perceived Exertion.

In our study, verbal encouragement versus passive observation was performance enhancing for both endurance and sprint exercise, a situation likely to also be experienced in team sports where the noise from numerically greater spectators at home matches would usually be positive. Therefore, positive encouragement from a home crowd might partly explain the substantial home advantage reported for sports such as Rugby Union (25.1% home advantage), Soccer (21.7% home advantage) and NBA Basketball (21.0% home advantage).[5]

External encouragement differs from external feedback insofar as technical aspects of feedback can be a distraction to performance whether these are intended positively or negatively. Encouragement is merely reinforcement of the athlete's existing performance strategy and as such it may be useful to aid motivation and adherence to the specific task. Therefore, in a major competition in the presence of spectators, encouragement might better aid maintenance of a performance strategy rather than detract from it, although this clearly depends on the nature of the task involved.[13] Further similarly controlled experiments are required to investigate the relative impact of technical information and/or negative comments but a clear effect is evident for spectators to verbalise encouragement rather than being passive, silent observers.

Consistent with the objective measures in this experiment, participants reported significantly higher subjective perceived effort (RPE) when provided with encouragement. This finding has a logical basis and is consistent with the EVE condition aiding the sustainment of a higher workload throughout the endurance and sprint tasks. It is well known that tasks requiring greater effort usually result in higher performances[18] and so it also supports previous controlled research comparing perceived effort and performance, where individuals routinely report higher levels of perceived effort in conjunction with higher performance indicators of power and speed.[23 24]

There was also a significant interaction between encouragement and the type of exercise in perceived effort (RPE). This showed that encouragement was perceived to be most effective in the endurance condition. This occurred despite the participants perceiving the sprint task to be harder overall. A possible explanation for this effect might be that the spectator was able to motivate participants with verbal encouragement to a greater extent in the longer duration bouts, where performance is often known to undulate due to the imprecision of pacing plans, uncertainty over energy reserves and self-doubt over physical capabilities to conclude the task within tolerable levels of discomfort.[12] It is also likely that maximal performance in the sprint task is closer to a ceiling effect for these participants, but less so in the endurance task, and thus the interaction reflects greater room for improvement in one task relative to the other. Additionally, when working at maximal effort such as in the sprint task, there are fewer opportunities for positive responses to encouragement than during slower pedalling in the 20 min endurance task. Therefore, EVE is likely have more impact on endurance activities than sprint activities due to time to act on the encouragement provided.

Participants' indicated higher levels of subjective fatigue in EVE in the endurance condition, which corresponds with participants' scores indicated by RPE. This is consistent with previous research reporting non-athletes feeling sensations of premature fatigue from exercise without well-constructed pacing strategies.[24] This is likely due to be a sense of lacking control during maximal performance with little self-reflection or reference to a strategy as the bout develops. More experienced athletes are able to refer to previous experiences of sensations at similar stages of a given event. Sensations of reduced fatigue at key checkpoints can provide positive self-regulatory information to athletes but inexperienced athletes are more reliant on their inherent pace judgement and reinforcement from the spectator that they are performing well. Therefore, as external encouragement decreased participants' subjective fatigue in the task perceived as harder, it suggests a coach may be able to help facilitate an optimal pacing strategy, decrease feelings of fatigue, and produce greater performance outcomes.[12] Thus, even without exercise experience, fatigue can be controlled through feedback mechanisms by a spectator or a personal trainer, particularly the harder and the shorter the duration of the task. This finding contributes to a greater understanding of the potential influence of external encouragement on sprint exercise which has not been reported previously.

Participants also perceived greater pain/discomfort in the exercise bouts in the presence of encouragement, which is consistent with the greater physical output and subjectively reported exertion at working to a higher level of physical effort. This is to be expected as higher speed and power outputs result in greater perceived pain/discomfort across all exercise.[23] Overall, participants in the EVE condition reported encouragements also increased the 'motivation to exercise tomorrow'. This is in line with previous research indicating that individuals become more motivated to adhere to exercise programmes after they have been trained by a coach and after exercise experience, particularly when the feedback is positive.[25] Thus, future research may investigate whether individuals with low initial motivation to exercise, by conducting a pre-exercise motivation to exercise evaluation, in order to determine what level of motivation for future exercise behaviour encouragement can elicit over time. This could have great implications for determining spectators, coaches or personal trainers' potential influence on motivation to continue exercise and adhere to exercise regiments with the physically inactive.[26]

There are some research limitations that need to be noted from the current study. For example, research has indicated that athletes have expectations that coaches will improve their performance, and this can become a self-fulfilling prophecy.[25] In addition, highly trained athletes may be less receptive to social facilitation than recreational athletes due to greater awareness of their physical capabilities.[12] The encouragement provided by the social facilitator covered technical, time and general motivation aspects, but all from a purely encouragement perspective. Specific technical aspects such as corrective actions for inadequacies of technique were not included in this study as they often promote self-doubt and can negatively impact on goal-focused motivation.[16] Although it was not observed in this study, it is plausible that males respond more positively to social facilitation from a female and vice versa. No gender-based effects were observed in this study and the same female social facilitator was used for all trials. Nevertheless, this effect may be worthy of further exploration in subsequent studies.

In conclusion, social facilitation with verbal encouragement increased physical performance during both endurance and sprint exercise sessions and also increased motivation to exercise on subsequent days which could be a practical strategy to increase training adherence. These outcomes are important for an array of health and exercise-related disciplines which seek to improve exercise performance, aid self-regulatory skills and increase motivation to exercise. This would in turn increase an individual's level of exercise self-efficacy and the likelihood of sustaining and maintaining regular exercise. Therefore, if a supporter, crowd, coach or personal trainer can facilitate better performance strategies by helping people gain the exercise experience needed to adequately regulate exercise intensity, they act to enhance both indirect and direct reinforcement for future exercise behaviour. Finally, the outcomes of this study could be applied to many sporting situations and consequently suggests that observers of sport might substantially aid performances with positive verbal encouragement.

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Patient consent Obtained.

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