

CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

THINK-ALLOUD: AN EXAMINATION OF DISTANCE RUNNERS THOUGHT-
PROCESSES

A thesis submitted in partial fulfillment of the requirements
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Dedication

To my family, this thesis serves as a symbol for all the love, support, guidance and encouragement you have given me throughout this journey called life.

Table of Contents

Signature Page	ii
Acknowledgements	iii
Dedication	iv
List of Tables	vi
Abstract	vii
Chapter 1: Introduction	1
Chapter 2: Review of Literature	3
Chapter 3: Methods	8
Chapter 4: Results	14
Chapter 5: Discussion	24
Conclusion	29
References	30
Appendix A: Physical Activity Readiness Questionnaire	33
Appendix B: Participant Demographic Form	34
Appendix C: Long Run Trial Basic Instructions	36

List of Tables

Table 1: Participant Demographics	15
Table 2: Subtheme and Major Theme Groupings	16

Abstract

THINK-ALoud: AN EXAMINATION OF THE DISTANCE RUNNER'S THOUGHT- PROCESS

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Master of Science in Kinesiology

A considerable amount of literature evaluating psychological variables associated with distance runners is currently available. However, a major limitation exists in the use of retrospective recall instruments that are used to measure these variables. An additional limitation in the available research lies within a lack of literature attempting to measure thought-processes in real-time during physical activity and competition. The “think-aloud protocol” is a promising methodology for closing the gap in the literature (Ericsson & Simon, 1980).

Literature to date regarding the think-aloud protocol has provided substantial evidence for the protocol's validity, yet the gap remains in utilizing the protocol with long duration tasks, such as long distance running. The purpose of this study was to continue an exploratory line of research using the think-aloud protocol and examine the thought processes of runners while completing a long distance training run. Ten experienced adult runners (5 males, 5 females) with a mean age of 29.8 years (SD=7.7), currently training for a half-marathon distance or greater race, participated in this study.

Participants were asked to verbalize their thought-processes while completing a long training run (8+ miles) while speaking aloud into an audio recorder.

Qualitative analysis of the transcripts revealed a total of 6,838 meaning units, which were further grouped into sub-themes and major themes. A final thematic structure identified six major themes that characterized these participants' thought-processes during a long run: social/occupational, environment, mental strategies, logistics of running, pain/discomfort, and think-aloud protocol (TAP). The results of this study provide greater understanding of the thought-processes of long distance runners, subsequently offering practical implications for sport psychology professionals working with this athletic population.

Chapter 1

Introduction

Humans have used running as a means of locomotion for thousands of years. Endurance running is believed to have originated specifically for hunting animals, as a means of survival. Written records date competitive running back to religious festivals in 1829 BC throughout Asia and Africa (Sears, 2001). Running has expanded from its original purpose of transportation and a necessary means to stay alive, and evolving into a competitive sport in developed countries. Over the last decade, marathon running in the United States has continued to reach record numbers of 518,000 in 2011 compared to 25,000 in 1976 (Running USA, 2013). In 2012, an estimated 850 marathons were held in the United States. This is a record high and has greatly increased compared to the 300 marathons held in 2000 (USA Running, 2013). Many runners take to running with similar motivations, as they progress in the sport, they simultaneously progress through different stages of motivation and thought processes (Johnsgard, 1985; Ogles & Masters, 2003).

Literature regarding long distance running is limited due to its use of retrospective data collection methods. Therefore, the think-aloud protocol provides an optimistic methodology to capture the thought-process of runners in real time throughout their activities. The purpose of this on-going study is to continue to explore work with distance runners utilizing the think-aloud protocol and examine their thought processes while participating in long distance training runs. This study extends the prior protocol established by Ericsson and Simon (1980) to a long duration task (distance running). Pilot data collected in 2012 concluded that endurance runner's focus on 4 major categories

while running: pace/distance, discomfort, mental strategies, and life issues. This study will attempt to replicate the original pilot data.

Chapter 2

Review of Literature

Even with growing popularity and accessibility, marathons have not always been viewed as a leisure activity. Before the 1970's marathons and long distance running was thought of as something reserved for only elite athletes (Ogles & Masters, 2000).

Marathon runners represent an unusual group of motivated individuals committed to a leisure activity. These runners voluntarily expose themselves to psychological and physical distress on a constant basis to maintain strict training programs and nutritional regimens (Ogles & Masters, 2000). Since marathoners willingly succumb to unusually harsh and rigorous training, this has opened the door for researchers to investigate these psychological and physical variables associated with distance running.

Carmack and Martens (1979) were among the first to investigate the motivation of long-distance runners. Their study concluded seven categories these individuals gave for running: psychological health, physical health, affiliation, self-image, social influence, achievement, rewards, and availability. Over the past three decades, additional researchers have conducted similar studies to identify the motivating factors behind participation in long-distance running events and races. Personal well-being and goal achievement were among the top conclusions regarding this population (Curtis & McTeer, 1981; Johnsgard, 1985; Masters, Ogles, & Jolton, 1993). Older runners have reported being motivated more by overall well-being such as weight control, life meaning, and building relationships with other runners. Younger runners identified motivation more frequently with personal achievement, which may refer to items such as

running a personal best time/finish, pushing oneself beyond his/her limits, improving speed or running technique (Ogles & Masters, 2000).

Researchers have studied many different psychological variables in relation to distance running including: self-esteem, sport motivation, personality profiles, perceptions of “hitting the wall”, confidence, affective states, perceptions of sensory experiences, and psychological skills/strategies used (Curtis & McTeer, 1981; Dobson, Martino, & Black, 2011; Hulley & Hill, 2001; Krueger, Pienaar, Du Plessis, & Van Rensburg, 2012; Martin & Gill, 1991; Masters, Ogles & Jolton, 1993; Ogles & Masters, 2003). Previous studies have concluded that runners who score higher in self-referenced variables such as self-esteem, self-confidence, positive affect states, and motivation are predicted to perform better (Barwood, Thelwell, & Tipton, 2008; Tammen, 1996). In addition, runners who tend to report higher positive interpretations of sensory experiences (pain, fatigue, etc.,) have better use of positive self-talk, utilize coping strategies, and integrate psychological skills into their training and racing to enhance their performance (Barwood, Thelwell & Tipton, 2008, Ogles & Masters, 2000).

The literature to date has greatly increased our current understanding of the psychological variables and thought-processes that accompany distance running. However, previous studies have utilized a combination of methodologies including surveys, interviews, and open-ended questionnaires to determine the thought-processes involved in running. The limitation lies with the fact that the majority of these sports psychology instruments, used to record thought processes during practice or competition, rely on retrospective recall (Nicholls & Polman, 2007; 2008). This hole in the literature fails in measuring thought-processes in real-time during physical activity. When a time

lapse between activity participation and reporting takes place, there is a greater risk for memory error to occur.

An innovative methodology to enhance the literature can be found within the think-aloud protocol, which defines the effects of performance outcomes in regards to different verbalizations (Ericsson & Simon 1980). According to Ericsson and Simon (1980), level 1 and 2, “verbalizing of spontaneous inner speech,” do not directly affect performance outcomes, yet are able to provide an appropriate methodology for capturing real-time thought processes throughout activity. Level one verbalizations are a simple thought while level two verbalizations are more complex thoughts accompanied with detail, adding more meaning. Seeking verbalizations that require explanations of thought (level 3), alter the cognitive process and thus affect the performance outcome (Fox, Ericsson, & Best, 2011). During the development of this protocol, several cognitive psychologists voiced concern that verbalizing thoughts would in fact affect performance, however, after many years of research and experimenting, studies have shown the opposite, that when participants were asked to simply verbalize their thoughts without further explanation, they were able to capture their thought processes accurately and without disrupting performance (Fox, Ericsson, & Best, 2011). In the sport and physical activity domain, previous research has provided evidence that the think-aloud protocol is a valid instrument determining thoughts during short-term physical activity; however, the existent gap of literature with this protocol remains with the long-term physical activities such as distance running.

To date, the think-aloud protocol has been accepted as an authentic method for investigating thought processes during short-term physical activity (Crutcher, 1994;

Ericsson & Simon, 1998). It has been utilized to conduct research with elite and non-elite chess players to examine differences and similarities in thought process during play. Adriaan de Groot's findings (1946/1978) show that there is little difference between the way "grand masters" and "candidate masters" search the playing board for the next best move, but there are noticeable differences between elite and novice players (de Groot, 1946/1978; Ericsson & Smith, 1991). Ram and McCullagh (2003) used the think-aloud protocol to study the effects of self-modeling on performance in intermediate level volleyball players. The researchers determined that self-modeling may lead to an increase in serving accuracy in performance outcomes (Ram & McCullagh, 2003). Most recently, Nicholls and Polman (2008) used the think-aloud protocol to determine stressor and coping strategies among five high-performance adolescent golfers, specifically using level 2 verbalizations, over six holes. The results of this study concluded that stress and coping is an ever-changing process that transforms throughout the many stages of performance. The golfers in this study experienced up to five stressors before identifying a coping strategy (Nicholls & Polman, 2008).

With the recent protocol research indicating promising results, the aim of this investigation is to use the think-aloud protocol to study the thought processes of long distance runners. With various physical and psychological demands on runners it can be assumed that insight into their thought processes while training may provide key information for sports psychology professionals to assist runners with the emotional and mental support they may need.

The purpose of this study is to continue exploratory research with distance runners following the think-aloud protocol and examine their thought processes while

participating in long distance runs. This study applies the prior protocol established by Ericsson and Simon (1980) to a long duration task (distance running). Pilot data collected in 2012 concluded that endurance runner's focus on four major categories, consisting of subthemes, while running: pace/distance, pain/discomfort, mental strategies, and environment. This study will attempt to replicate the original pilot data and/or determine if additional categories and meaning units are present in the runners thought process.

Chapter 3

Methods

Participants

Qualifications for participation in this study included: completing at least one marathon (26.2 miles) within the past year, currently training for a half-marathon or greater distance race, be at least 18 years old, and agreed to complete both parts of the study (treadmill and long run trials). Ten experience adult runners (5 women, 5 men) with an age range of 20-45 years old ($M=29.8$ years, $SD= 7.7$) volunteered to participate in this study. Participants were compensated for their time and participation with a gift card to a local sporting goods store.

Procedures

The procedures utilized in this research study were consistent with Ericsson and Simon's (1980) guidelines for conducting a think-aloud protocol. The protocol requires individuals to verbalize their thought-processes ("think-aloud") on a repeated basis throughout the pre-designed task as described below.

After approval was gained from the Institutional Review Board, potential participants for the study were recruited from different local running groups that the researchers contacted. Informational packets consisting of the purpose of the study and inclusion qualifications were distributed. Interested participants who met the required inclusion criteria were scheduled for their treadmill trials on separate days and times convenient to them. All treadmill trials were conducted on a university campus in an exercise physiology laboratory, on the same treadmill and lasted approximately 30 minutes.

The treadmill trials were facilitated and monitored by a member of the research team.

Treadmill Trial

Before beginning the treadmill trial, each participant completed informed consent and demographics forms in addition to a Physical Activity Readiness Questionnaire to determine readiness for physical activity (PAR-Q; American College of Sports Medicine, 1994). For copies of the form, please refer to appendices A-C. Upon completion of the forms, participants were led through three warm up tasks to familiarize themselves with the think-aloud procedure designed by Ericsson and Simon (1980). Researchers led each participant through the same instructions verbatim as listed below:

“In order to follow your thoughts we would like you to verbalize everything that passes through your head. Do not try and explain anything, pretend there is no one here, but yourself. The key thing is to talk aloud constantly from the minute I present the task.”

The following warm ups were given to the participants-

- a.) Math Problem- “I would like you to talk aloud as you multiply 19 times 6 in your head”.
- b.) Anagram- Now I would like you to solve an anagram. I will show you a card with scrambled letters; it is your task to find an English word that consists of all the presented letters. For example, if the scrambled letters are KORO, you may see that these letters spell ROOK. Any questions? Please “talk aloud” while you solve the following anagram:

<NPHEPA=HAPPEN>

c.) Naming/free association task- “Now I would like you to talk aloud as you name twenty different animals. Simply verbalize what passes through your mind as you name them.”

These warm up exercises allowed the researchers to determine the accuracy of the participant’s verbalizations as well as their comfort level with the task (Ericsson & Simon, 1991). If the researchers observed a participant struggling to think aloud during a warm up task, additional exercises that closely resemble the initial three were provided for more practice. No participants required additional warm up tasks. Upon proper completion of the warm up tasks, participants were fitted with a small digital audio recorder (Olympus DS-400), with a microphone attached to the collar of their t-shirt and a *Spibelt* (small fanny pack runners use to carry little items while running) were used to hold and secure the equipment during the trial run. All participants completed a 5-minute physical warm-up on the treadmill at a self-selected pace. During this time the researchers verified that the recording equipment was operating properly and the participants felt comfortable.

Once the participants felt they completed an adequate warm up and were ready to begin, they were instructed to run on the treadmill for 30 minutes at a self-selected conversational pace, similar to their normal training pace. During the 30 minutes, they were encouraged to verbalize their thought process in real-time without explanation (level 2 verbalizations) as established by the think-aloud protocol (Ericsson & Simon, 1980). Participants were instructed to attempt to not stay quiet for longer than 20 seconds at a time, or the researcher would remind them to “think aloud”. All ten participants

successfully completed their 30-minute treadmill trials non-stop and verbalized their thoughts appropriately.

After completing their treadmill trial, all participants had a short discussion with the researcher to receive instructions for the long run and addressed any difficulties or concerns the participant had with the think-aloud protocol. Some participants were concerned with verbalizing “any and all thoughts” for the long run trial, but felt they were comfortable enough to complete the long run portion. The purpose of the treadmill trial was to familiarize the participants with the think-aloud protocol, the equipment and for the researchers to test the equipment in a controlled laboratory setting.

Long Run Trial

After the treadmill trial was completed, each participant was asked to participate a long run of 8 or more miles on their own at a destination, time and date convenient to them. Participants were asked to attempt completing the long run within one week of the treadmill trial. Each participant was given a long run instruction packet containing directions to operate the recording equipment (recorder, microphone, Spibelt). Before the long run trial, participants were to verbally state their subject number, intended distance and pace into the recorder. Participants ran at a self-selected conversational pace. Participants were to use their personal GPS watches to track distance and pace. If a participant did not have access to a GPS watch, a research team member loaned them one. Each participant was directed to complete the run while talking aloud as frequently as possible, following the same protocol they were given during the treadmill trial.

After completing the long run trial, participants were instructed to verbally answer the post- run questions into the recorder that was provided to them in the instruction

packet. In addition, participants were encouraged to provide supplemental comments or concerns regarding their run, if their goals were achieved (distance and pace), how they felt or any questions in regards to the study. Participants also answered the data form from their packets that asked for mileage, pace per mile from the GPS watch, and total run time. Researchers scheduled times to meet each participant and collect the equipment that had been loaned to them as well as the completed data forms, once they finished their long run trial. At this time, each participant was given a sporting goods store gift card as compensation for participating in this study.

Data Analysis

All twenty audio recordings (10 treadmill, 10 long run) were uploaded electronically and transcribed verbatim. Each thought was recorded on a separate line. The think-aloud analysis procedures outlined by Ericsson and Simon (1993), identify problem-solving tasks regarding relevancy, consistency and patterns of verbalization. However, a line-by-line inductive content analysis was used due to this being an exploratory study, as well as one that investigates a wide range of thought patterns during a continuous physical activity (distance running). This analysis procedure was similar to the previously mentioned study that identified stress and coping mechanisms using the think-aloud protocol with golfers (Nicholls & Polman 2008).

A research team member read each transcript individually to further analyze each runner's thought-processes. True to hermeneutic procedures outlined by Thomas and Polio (2002), pertinent informational statements were identified as meaning categories. These categories were broken down further into groups of sub-themes and major themes. This process of identifying categories was completed individually, but later discussed by

the whole research team. A continuing inquiry and discussion aided in determining the final thematic structure and the total number of themes.

Chapter 4

Results

A total number of 12 participants began the study, two were lost due to failure to properly complete the long run trial, leaving the final number at 10 runners who completed the treadmill and long runs according to protocol. The demographic information collected showed that participants reported running 1-5 days per week ($M=4$ *days*) and between 6-40 miles ($M=20$ *miles*). For a complete listing of participant demographics, please refer to Table 1.

Table 1.
Participant Demographics

Participant Number	Gender	Age	Ethnicity	Years of Running Experience	Current Weekly Mileage	Number of Days Running per Week	Next Race Distance
P1	M	27	Caucasian	3	20	4	Half IM Triathlon
P2	F	31	Caucasian	5.2	15	4	Half-Marathon
P3	M	39	Caucasian	1	40	5	Ultra-Marathon
P4	M	45	Caucasian	35	30	4	Marathon
P5*	M	43	Caucasian	20	40	5	Ultra-Marathon
P6	F	34	Caucasian	20	15	3	Marathon
P7	F	22	Hispanic	12	25	3	10K
P8	M	24	Caucasian	12	20	5	Marathon
P9	F	20	Hispanic	13	15	5	Marathon
P10*	F	21	Hispanic	12	10	2	NA
P11	M	29	Caucasian	4	20	1	Marathon
P12	F	27	Caucasian	9	25	4	Half-Marathon

Note. “P” refers to participant number. An * indicates a participant who did not complete the protocol and was not included in the analysis.

The long run transcriptions consisted of 314 pages of thoughts-processes, resulting in 1,001 minutes (16.69 hours) from the participants. This study identified a total of 6,838 meaning units. The original analysis of the transcripts identified 10 major theme categories that were present: environment, life issues, mental strategies, pace and

distance, running, pain and discomfort, think-aloud protocol (TAP), hydration/nutrition, physical activity, and heart rate. Upon a second analysis and discussion by the research team, the original 10 categories were combined into a final 6 major themes. The final 6 themes were social/occupational, environment, mental strategies, logistics of running, pain and discomfort, and TAP. For a visual depiction of the subthemes and major themes, please refer to Table 2.

Table 2.
Subtheme and Major Theme Groupings

Raw Subthemes (# of meaning units)	Major Themes
Life (1,757)	
Running (437)	Social and Occupational (2,239)
Physical Activity (45)	
Environment (2,003)	Environment
Mental Strategies (1,225)	Mental Strategies
Pace and Distance (714)	
Heart Rate (34)	Logistics of Running (817)
Hydration/Nutrition (69)	
Pain and Discomfort (420)	Pain and Discomfort
Think Aloud Protocol (134)	Think Aloud Protocol (TAP)

Social and Occupational

Social/occupational thoughts were a major theme that consisted mainly of non-running related issues: career, family/friends, and physical activity/running (other than

the run participants were completing). While this major theme tallied the most meaning units (2,239), these thoughts do not pertain directly to the runs the participants completed for this study and thus were placed in a separate category.

Career Participants thought about their career and work as they ran. Many thoughts revolved around the daily schedule of their career or problem solving work related tasks, for example “working at the Pilates spin studio teaching spin 2 or 3 days a week, going to be doing that for awhile” (P1) and “I hope they get back to me about scheduling that meeting Wednesday morning” (P2).

Family/friends Often participants thought about their family and friends. Being social by nature, it is normal to experience thoughts of others important in their lives, for example “it’s been fun putting the baby to sleep, I won’t have that many opportunities once the semester starts”(P11) and “I am not paying for school but you cannot really replace family...that’s one of the great things about Thanksgiving is coming together with your family”(P8).

Physical activity/running Since the participants of this study are very active, it comes as no surprise they partake in various forms of physical activity in addition to running. Participants referred to other forms of exercise that they participate in such as yoga, swimming, and exercise tapes or programs. “That t-25 workout yesterday was a big one” (P12), which is a High Intensity Interval Training exercise DVD. Since this study focused on a population of experienced runners, running was also a common sub-theme.

Thoughts that fell into the “running” category did not relate to the long run trial they were participating in, but rather how they learned about running, running apparel, or races they had completed or were training for “I have to remember to register for the Venice

Christmas run”(P2) and “went for that 50 mile bike ride yesterday, training for that half Ironman” (P1).

Environment

The second largest major theme was the environment with 2,003 meaning units, sub-themes of this category included geography, wildlife, and traffic and others.

Geography Runners completed their long runs on trails or within the city. The environment they chose to run in greatly impacted most of their thought-processes. Participants were very aware of their surroundings and environment. They often sounded appreciative, “it’s so beautiful over here, this is where I would definitely move to... decent into the beautiful Santa Rosa Valley, looking back down to the valley heading east, the sun is rising over my right hand” (P4) and “crazy there’s no more snow left, it all melted over night, it’s like spring!” (P12). While most thoughts were positive about the environment or stated out of admiration, others had different thoughts, “it’s way too windy, like tornado style, I didn’t think the car would be able to hear me” (P7) and “why does this guy have his freaking lights on dude, it’s so bright out here, super crazy.... is that fake grass? It is fake grass, how funny!” (P9). Participants were aware and perceptive of their environment whether it was trail or road running.

Wildlife Many of the participants seemed to be running by the ocean, through the canyons or on woodland trails and encountered many different types of wildlife, “there’s tons of feathers everywhere, little white feathers, there’s a bird, I just looked over and there was a bird” (P6) and “hello cow staring right at me, kind of a funny looking cow” (P12). Other participants were slightly worried and remained aware of more dangerous wildlife “up the hill, that would be cool if that was a mountain lion!” (P5) and “oh a

snake! A dead snake but it was a snake, baby rattler maybe 8-10 inches” (P4). Overall, participants seemed to appreciate and admire the environments they were running in. Environment played an integral part into the runner’s thought-processes and positively influenced their running experience.

Traffic & others Living in a densely populated area, it is expected that the participants would encounter traffic and others on their runs. Traffic seemed to negatively impact participants “I hope he sees me...okay he waited for me, that car saw me” (P11) and “dang it, hate that I have to stop, street lights freaking suck” (P9), as well as highly congested areas, “oh those people almost ran into me” (P6). In addition, participants encountered other runners, walkers, and cyclists “I can hear voices behind me, I hope it’s the mountain bikers or runners...another biker” (P4) and “oh cool there’s a horse up trail, hard to believe they can do the trail” (P5). For some participants, greeting and speaking to others they passed was something they frequented during their run “how you doin’ man? Was this a buddy of yours?” and “ hi, how’re you doing?” (P11).

Mental Strategies

Participants utilized different mental and coping strategies they felt were best to push through difficult parts of their run, encourage themselves and complete the task, accumulating 1,225 meaning units. Most participants used self-talk to motivate themselves to continue and work through difficult terrain of the run “oh man this is a long ass hill...one step at a time, one second at a time...good job made it to the top without stopping!” (P5) and “okay time for the steep one, we can do it...stride out, dig deep, good job” (12). Others used self-talk to remember and maintain proper form and technique “relax your neck, relax your shoulders, shake out your hands, don’t rush” (P2) and “come

on legs, get me there” (P4). One participant recognized she was getting down on herself and refocused to more encouraging thoughts “seriously negative feedback, oh my gosh...okay, let’s go” (P9).

Logistics of Running

This major theme combines different areas runners focus on and are aware of to optimize their run and perform to the best of their abilities. This category is made up of pace and distance, heart rate, and nutrition/hydration.

Pace & distance Participants frequently thought about their pace and the distances they traveled or had yet to complete. By tracking pace and distance, participants were able to determine their performance “still warming up, but 8:41 (minute per mile) pace I’ll have to pick that up in a little bit but I kinda don’t want to...haven’t even gone a mile and a half yet” (P11) and “I’ve been going 47 minutes... I went further, pick up my pace a little” (P6). Participants who commonly thought of distance were often searching for half way points or longing for the end of their run “I gotta be tired today, I’m already thinking about the last mile to the car, and whether to throw in an extra loop, extra half mile” (P4) and “home free, two more miles down this road, turning around before the intersection” (P12). Since all participants are currently training for a race of either a half-marathon distance or greater, it was to be expected that many of their thoughts focused on controlling their pace.

Heart rate Similar to tracking pace, tracking heart rate is an important factor to many experienced runners. Often times runners have a targeted heart rate they want to train at to maximize performance or to not over train. Some participants had very specific heart rate goals “try to get my heart rate up to 80% see if that warms me up” and “got my heart

rate up to about 85% maybe 90 at the end” (P5). However, others focused more on a zone and the need to control heart rate “heart rate is getting too high...the goal is to keep a relaxed heart rate” and “heart rate is high but you pretty much have to walk up this hill to keep your heart rate low enough” (P12).

Hydration & nutrition Fuel source plays a critical factor in physical activity and performance. It is no surprise that participants experienced thoughts about hydration and nutrition during the run, but also reflected on intake before the run and how they would refuel post run. Some participants thought of hydration more frequently “I am so thirsty...oh I can’t wait for my water, ice water sounds so good” (P6) and “good thing I brought water, it’s getting warm...sip of water feels good” (P4). Several participants felt they did not adequately fuel their bodies before their runs “had a goo shot before but forgot to bring another one” (P11) and “I’m kind of thinking half of a pro bar and one goo may not have been sufficient” (P4). One participant felt they needed to fuel during his run, since he did not eat breakfast “I need a goo, this is unplanned, I need a goo, you started on an empty stomach see if that works, get the system going... alright that’s two gels” (P5). Several runners became hungry midway through their runs and shifted focus to refueling once their runs were completed “man I’m hungry now, all I can think about is food...I want to see if JD wants to go get breakfast, I’m going to be really hungry when I get back” (P1) and “definitely need to make myself a little protein drink, help my muscles recover after this run” (P8).

Pain and Discomfort

The fifth major theme was pain and discomfort, with a total of 420 meaning units. Most thoughts regarding pain dealt with minor injuries, stiffness, and soreness “I’ve got

enough lactic acid in my legs for an army” (P5), “oh but it hurts, quads, hammys, not an injury just fatigue” (P4) and “my legs are pretty tired today, that was just a tiny hill and it was like oh dead legs” (P12). One participant experienced GI discomfort on their run “my stomach feels weird, stomach let’s get it together...okay I seriously have gas” (P2).

However, other thoughts aligned more with general discomfort such as dealing with temperature “cold coming in on my ankles making my Achilles sore...cold feels alright, just my ears and nose are cold, my throat getting a little burn too” (P8) and “dude it’s November, why is it so hot, the sun is killing me, my lips are super chapped...I stink just like sweat” (P9).

TAP

The final major theme is the think-aloud protocol, or thoughts relating directly to this study with 134 meaning units. While thoughts about the think-aloud protocol would not occur naturally on a run, the participants were mindful of the equipment they were carrying “should tighten this belt up a little more” (P9) and “I’m going to check if it is still recording, yeah it’s still good...I know I turned it on hold” (P8), as well as the instructed task to talk-aloud “hope you can hear me, am I talking too quietly, am I mumbling...man I hope I’m talking loud so the microphone is picking me up” (P11). Other participants were in tune to how talking aloud affected their running “talking and running is really winding me” (P6), “I’m having my doubts about being able to talk the whole time” (P2) and “it’s kind of hard to talk and concentrate on breathing and getting a good breath...I’m not used to talking the entire time when I’m running” (P6). Several participants became incredibly aware of their surroundings and others that they passed, becoming self-conscious “so unless I get awfully comfortable, I don’t think I will talk out

loud when people are around” (P7) and “I’m sure people are looking at me so weird, like dang that girl has so many wires on her” (P9).

Chapter 5

Discussion

The purpose of this study was to fill gaps in the literature by continuing exploratory research with distance runners (long duration task) following the think-aloud protocol and examine their thought processes while participating in long distance runs. This study attempted to replicate the original pilot data from 2012 (pace/distance, pain/discomfort, mental strategies, and environment) and determine if additional categories were present in runners' thought processes. With this study being the first of its kind, utilizing the think-aloud protocol while performing a long duration task, there are limited previous studies to connect the results with.

Overall, several of the results appeared consistent with the pilot data from 2012. The expectation for this study was to replicate the same categories found during the pilot data, as well as any additional categories. The data showed three categories that were common in both phase one and two: environment, mental strategies, and pain/discomfort. A fourth category, logistics of running, was formerly referred to as pace and distance in the pilot data but was absorbed into a broader category with other previously mentioned subthemes. Two additional categories, social/occupational and TAP, were present in the data that were not previously observed.

The most prominent theme runner's mentioned were social/occupational thoughts. This was not congruent with the pilot data, as there was no need for this category based on the runner's thoughts. Career-related thoughts, which is a subtheme to this category, may have been present due to work and careers consuming most of an average adult's day and time. It is not surprising that work related thoughts often arose while running. In

addition, exercise is frequently utilized as a stress reliever and with the work place or work related tasks causing almost daily stress, it is understandable for the two to be paired. Friends and family may have been frequent thoughts since they are often sources of happiness, comfort, or stress. To focus on something happy and comforting during a difficult task and/or running to work out those stresses, makes good use of time while exercising. However, this is speculation because there is no available research regarding outside stressors on physical activity using the think-aloud protocol.

Congruent with the original pilot data, environment was the second largest category. One can speculate that thoughts relating to the environment showed prominence in runner's thinking due to the runs taking place outdoors. While running different paths, runners must have a planned course and remain familiar with their surroundings whether that means what street to turn down or where to turn around. Other participants enjoyed running trails simply to admire the environment and nature around them. Perhaps participants would not discuss their surroundings and environment as much if they ran on an indoor track or treadmill.

Another category congruent with previous research was mental strategies. As a successful competitive athlete, it is important to learn and utilize appropriate mental strategies during competition and training. Several mental strategies that were prominent were positive self-talk, visualization, and maintaining form. Participants frequently stated a stressor followed by a coping strategy similar to Nicholls and Polman's (2008) study. By encouraging oneself to keep going or that they could accomplish the task they were able to stay engaged in the run. If runners were not mindful of their form and technique they could have sustained injury or failed to complete the intended distance and pace. It is

important for the participants to remain mentally engaged in their training and appropriately cope with stressors that may arise throughout physical activity.

The logistics of running theme was similar to the pace and distance category from the pilot data. However, subthemes such as heart rate and hydration/nutrition were absorbed into this major theme in addition to thoughts regarding pace and distance. For competitive distance runners to be successful, they are required to train and perform at specific paces for varied distances and courses, requiring them to be mindful of their pace. While exercising for long periods of time, they must properly fuel themselves before, during and after runs to optimize performance and keep the body healthy.

The major theme of pain and discomfort is congruent with the pilot data also. With all of the participants actively training for long-distance races, it is expected that countless mileage preparation takes a toll on their bodies. Therefore, participants were thinking of any pains, injuries, or stiffness they were experiencing that day. Often times by focusing on the pain or discomfort they were feeling, participants were able to adjust their technique, stop to stretch, or modify their clothing to minimize the pain and discomfort they were tolerating.

The final major theme, TAP, was not congruent with the pilot data as thoughts directly pertaining to the study did not exist. Since this was not a major theme previously, and participants were instructed to verbalize their normal thought-process and pretend the researchers were not present, it was surprising this was prominent. It is to be expected participants would occasionally reference the study since they were not only carrying additional equipment on their run, but they were being asked to verbally state their thoughts aloud throughout the entire run. It is speculated that this is not something the

participants normally do. In prior TAP research, participants did not mention the protocol while performing the desired task (de Groot, 1946, 1978; Nicholls & Polman, 2008; Ram & McCullagh, 2003).

Limitations

One limitation of this study was the small number of participants. Even though the results were conclusive, having additional participants might yield different major themes or more strongly confirm the current categories of thought. However, since this study was in phase two, a small sample size was feasible. A second limitation of this study was that it was a new line of research and there was limited available research to compare this study with. This study aspires to continue filling current gaps in the literature and be used as a reference in future related studies.

While this study focused on the concept of the possibility to collect runner's thoughts while performing a long duration task (distance running), it is hoped that eventually this study can be used during performance. Currently, collecting data during competitive races poses issues that may affect performance, yet it remains the long-term goal. Understanding thoughts during training as well as performance will assist sports psychology professionals when working with athletes.

Suggestions for Future Research

Current available research regarding the think-aloud protocol of distance runners is lacking. The limited research suggests a continued need for critical evaluation of the distance runner's thought-process and how it may enhance or detract from training and performance. Future research should focus on expanding the sample size and experience of the participants. A larger sample size could provide clearer conclusions about the

frequency of thoughts and/or major themes in runners' thought-processes. This would give greater insight into the running population.

Data analysis showed each participant of this study predominantly had more thoughts in one category than the rest rather than their thoughts being equally dispersed among all groups. Future studies could be conducted repeating the long run trials, using the same participant, to identify if the frequency of meaning units and categories are similar each time the subject runs.

Modifications to the current protocol may need to be adjusted so participants are not as concerned with the think-aloud protocol and equipment during the run. It is appreciated the participants took the study seriously and wanted to comply with the guidelines to the best of their ability. However, think-aloud comments about the equipment or process would not naturally occur during runs. Additional studies may look to find if any correlations between heart rate and pace exist in the participant's thought-processes. While it is known that participants have thoughts relating to their running environment, future researchers could compare the thought-process of runners who run on off road trails verses within city street limits for similarities or differences. Future research is needed to determine how to transition this protocol from training tasks to effective protocols incorporating it to performance settings.

Conclusion

In conclusion, this study aimed to identify the major themes found in the distance runner's thought-processes using the think-aloud protocol during a long duration task. Researchers were hopeful that this study would replicate the pilot data collected in 2012 as well as identify new themes present during the long run trials. It was found that a total of 6 major theme categories existed; four categories were replicated (environment, mental strategies, logistics of running, and pain /discomfort) with the addition of two new major themes (social/occupational and TAP).

This study is important because it begins to fill the gaps in the literature by collecting data in real time, no longer utilizing retrospective recall in the realm of sport psychology. This particular study expands the current think-aloud protocol to a long duration task and looks to continue expanding to enhance performance. By filling these gaps and collecting data in real time, this study is a promising start to much needed research in understanding athlete's thought-processes. The data will provide insight into the thought-processes during running and will aide sports psychologists in the field with athletic intervention.

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Appendix A

Physical Activity Readiness Questionnaire form

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

	Questions	Yes	No
1	Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?		
2	Do you feel pain in your chest when you perform physical activity?		
3	In the past month, have you had chest pain when you were not performing any physical activity?		
4	Do you lose your balance because of dizziness or do you ever lose consciousness?		
5	Do you have a bone or joint problem that could be made worse by a change in your physical activity?		
6	Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?		
7	Do you know of <u>any</u> other reason why you should not engage in physical activity?		

If you have answered "Yes" to one or more of the above questions, consult your physician before engaging in physical activity. Tell your physician which questions you answered "Yes" to. After a medical evaluation, seek advice from your physician on what type of activity is suitable for your current condition.

Appendix B

Participant Demographic Form

Subject #: _____

1. Please indicate your gender:
2. Please indicate your age:
3. Please indicate your ethnicity:
4. How many miles in a week do you currently run?
5. How many days per week do you currently run?
6. On days that you run, how many miles, on average do you run?
7. What is the longest mileage you currently run on any given day?
8. Are you currently affiliated with any running groups?
9. What percentage of your running is spent (total to 100):
 - a. On a treadmill?
 - b. Trail running?
 - c. Outside (canal paths, streets, or pavement)?
10. How long have you been running? (Please indicate years and months)
11. In the past 12 months, how many competitive races have you completed?
 - a. Please indicate the distances associated with the race(s) you indicated in

the previous question. (Give each race distance category a numerical value for how many you've completed in the past 12 months; for example, 5K, 10K, ½ marathon, marathon relay, marathon, ultra marathon)

- b. Indicate the number of these races that have taken place in the past 3 months.

12. Are you currently training for an event? If so, indicate the distance.

- a. Please indicate the distance of the event for which you are training (check all that apply)

- i. 5K
- ii. 10K
- iii. ½ marathon
- iv. marathon relay
- v. marathon
- vi. ultra marathon
- vii. other

13. What is your average pace for long runs?

14. What is your personal best in the marathon distance?

15. Have you sustained any running-related injuries in the past year?

Appendix C

Long Run Trial Basic Instructions

Thank you again for participating in this study. Your contribution will help researchers to better understand the psychology of distance runners and, thus, provide information on how to best help athletes like you improve upon your performance. Please read through the directions in their entirety before beginning your run. It is very important that all instructions be followed. Thank you again for your time. Have a great run!!! ☺

1. Turn on the recorder (slide the power button on the side) and thread the microphone through your shirt (or however you prefer) and attach it to your collar. After making sure it is on and hit “record”. Once you see that the recorder has started, slide the power button up in the direction of the word “hold” on the side of the recorder. This will keep it from accidentally turning off during the run. Place the recorder inside of the spibelt and clip it around your waist.
2. Flip to page 2 of this packet and answer (out loud) the “Pre-Long Run” questions on the top half of the page.
3. Run, run, run, run!!!! (while talking aloud!!!)
4. When you have completed your run, answer (out loud) the “Post-Long Run” questions on the bottom half of page 2 of this packet.
5. Flip to page 3 and fill in the data from your run, according to your Garmin times. Please not that a long run should be at least 8 miles. If your run was longer than 25 miles, feel free to add more lines to fill in your times. Don’t forget to put your total time at the bottom.

Pre-Long Run Questions

(These questions are to be answered verbally into the recording device before the run.)

1. What is your subject number?
 2. Please comment on the intended distance for the run.
 3. What is your projected goal pace?
 4. Any other relevant information that you think we (the researchers) need to know?
-

Post-Long Run Questions

(These questions are to be answered verbally into the recording device after the run.)

1. Please comment on the success of your run?
2. Did you maintain goal pace?
3. How did the run feel?
4. Please provide any questions/comments regarding the protocol.

Subject Number:	Date of Run:
<u>Mile</u>	<u>Split</u>
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
Total Run Time:	

Thank you for your participation in this study!! Please return the recording equipment (and Garmin, if applicable) to the researchers as soon as possible in order to receive your \$25 gift card!!!! 😊