

# The effects of International Poi on physical, cognitive, and emotional health in healthy older adults

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy,  
The University of Auckland, 2018.



# Abstract

We are currently experiencing unprecedented population ageing worldwide, and effective, affordable strategies for maintaining quality of life are urgently needed. International Poi involves swinging a weight on the end of a cord in circular patterns around the body. The aim of this thesis was to investigate the effects of International Poi, as compared to Tai Chi, on physical, cognitive, and emotional health in healthy older adults. Seventy-nine participants (60 – 86 years old) were randomly allocated to the International Poi or Tai Chi group. Physical and cognitive function were measured one month before, immediately before, immediately after, and one month after the intervention (2 lessons a week for 4 weeks). Follow-up questionnaires were administered after each lesson, immediately after the intervention, and one month after the intervention.

Immediately post intervention both groups improved postural stability, upper limb strength, and simple attention. The Tai Chi group also improved systolic blood pressure. One month post intervention, compared to immediately post intervention, both groups improved upper limb strength, upper limb range of motion, and memory. The poi group also improved systolic blood pressure. Questionnaire results showed both groups felt primarily relaxed during the intervention, with the International Poi group feeling more challenged and happy, and the Tai Chi group feeling more calm and peaceful. The majority of participants reported wanting to continue their practice, suggesting both activities are enjoyable.

This was the first study to scientifically investigate the effects of International Poi on health in older adults. Based on this thesis, it can be concluded that International Poi seems to be as effective as Tai Chi for improving health in healthy older adults, and that International Poi and health is a legitimate

area of scientific research. The possibilities for future poi and health research are vast, and the need for such research is paramount in order to replicate results, better understand potential long-term benefits, and begin to make recommendations for policy makers and practitioners regarding poi-health initiatives.

# Acknowledgements

To my parents, Spider, and all of the friends and strangers who have supported this crazy poi journey...thank you. I could not have done it without you.

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# 1. Introduction

## 1.2 Preface

Ten years ago, while moping around circus practice with a torn rotator cuff, boredom and curiosity led me to try the most unimpressive prop under the big top: a sock filled with rice. It didn't involve flipping and flying through the air. It didn't involve extraordinary strength or speed. It didn't appear to involve much at all, just holding one end of the sock and spinning the other weighted end in circles. But as soon as I felt that unimpressive sock orbiting around my body, something happened. Something big. And I was about to spend the next 10 years trying to figure out exactly what it was.

From that moment on poi became a staple in my life. I opened a poi center in the U.S., where I held lessons and sold equipment made by local artists. I invented a poi musical instrument and wrote an entire master's thesis about it. I gave a TEDx talk about the potential of poi not only as a performance medium but as a tool for improving wellbeing. I brought my poi everywhere, and took poi breaks throughout my day like a chain smoker. And yet, I was still running into roadblocks whilst trying to introduce poi to places like rehabilitation centers, hospitals, and nursing homes. They wanted to know why, exactly, poi felt so good, and my myriad of stories and experiences was not the type of evidence they were looking for. They wanted research; they wanted evidence based data.

And so, logically, I dropped everything and traveled to the other side of the world, to New Zealand, to get that data. To measure the effects of poi on physical, cognitive, and emotional health. To discover how science and culture might meet, and what they might say to each other about a weight orbiting on the end of a string.

## 1.3 Context: ageing, quality of life, and poi around the world

We are currently experiencing unprecedented population ageing worldwide, with older adults projected to outnumber youth for the first time in history (World Health Organization, 2017a).

According to the United Nations World Population Ageing report (2015),

Population ageing—the increasing share of older persons in the population—is poised to become one of the most significant social transformations of the twenty-first century, with implications for nearly all sectors of society. (p. 1)

As we increase our lifespan, the pervasiveness of chronic disease also increases, and one consideration of utmost importance is quality of life. We may be living longer, but are we enjoying good quality of life in our later years? It is crucial to address this question, as poor quality of life not only impacts individual wellbeing, but that individual's ability to contribute to his or her family, local community, and society more broadly, along with creating an increased demand for health care to prevent and treat chronic conditions (World Health Organization, 2015). If quality of life can be prolonged, we can not only improve individual health and wellbeing, but prolong active participation in society and attenuate health system pressures (United Nations, 2015). Therefore, simple, effective, and affordable strategies for maintaining quality of life are urgently needed. This thesis proposes one such strategy: International Poi.

Poi is both the name of an object (a ball on the end of a cord) and the way you move with that object (swing it in circular patterns around your body) (Paringatai, 2009). It has been practiced by the Māori of New Zealand for hundreds of years, where it is believed to have originated and continues to play an important role in Māori culture. Various styles have also spread across the globe, which will here forward be referred to as International Poi. This thesis explores the effects of International Poi on

physical, cognitive, and emotional health in healthy older adults. It is the first study to scientifically investigate the effects of poi on health in older adults.

## 1.4 Aims and objectives

The main aims of this research were to investigate the legitimacy of International Poi as an area of scientific research, and the efficacy of poi as a tool for improving health and wellbeing for healthy older adults. To accomplish these aims, the following objectives were established:

1. Conduct a randomized controlled study that systematically evaluates the effects of International Poi on physical, cognitive, and emotional health in healthy older adults;
2. Administer questionnaires to the study participants about their experience; and,
3. Compare and contrast International Poi with Tai Chi, which already has scientific research demonstrating its efficacy as a tool for improving health and wellbeing in older adults.

## 1.5 Significance

This thesis places poi in a health context, reviews and synthesizes literature on poi and health, and systematically evaluates the potential health benefits of International Poi. If this research can shed light on the potential of poi to significantly improve physical, cognitive, and/or emotional wellbeing in healthy older adults, it may give rise to a powerful and accessible health related strategy that has exciting implications for quality of life in old age. As the first study of its kind, the potential to create new possibilities for poi within the field of health, and pave the way for future research on poi, is tremendous. Such a simple, inexpensive, fun, and customizable activity may have potential benefits in a myriad of contexts, such as early onset dementia, stroke, ADHD, or depression. It may also have

special implications in Māoridom, as poi is a Māori taonga (treasure). The ageing Māori population has significantly higher rates of diabetes, high blood pressure, cardiovascular disease, cancer, and a shorter life expectancy than non-Māori populations in New Zealand (Ministry of Health, 2011). While many physical and mental health programs have been aimed at Māori populations in New Zealand, there are much fewer approaches offered in a whanau (family/community) context that utilize activities found within Māori culture. This research may set the stage for future studies investigating Māori Poi and Māori health.

## 1.6 Methodology overview

The primary aim of this thesis was to systematically investigate the effects of International Poi on physical, cognitive, and emotional health in healthy older adults. Therefore, the primary methodology employed was a quantitative positivist approach, more specifically an assessor-blind randomized controlled study. In addition, follow-up questionnaires were employed to augment the clinical study data. This interpretivist method was included in the hopes of generating a greater understanding of the clinical study data and the participants' experience. This may paint a fuller picture of the research, and thus potentially generate greater explanatory power for the researcher, shed light on data trends, illuminate qualities which set International Poi apart from Tai Chi, and provide a more robust foundation for future research.

## 1.7 Assumptions, limitations, and delimitations

The primary limitation of this research was financial support. The main consequence of this was a relatively small sample size, only one active control group and one active treatment group, and

limiting the means of measuring to tools which did not require much, if any, funding. These factors made the results of the trial less robust. Time was also a limitation, in terms of how much time participants could volunteer, and in terms of the overall timeline in which the study needed to be completed. In addition, for travel reasons, the sample was limited geographically to the greater Auckland, New Zealand area. The baseline measures of age and no previous experience with International Poi or Tai Chi were also delimiting factors. This study hinges on the assumption that Tai Chi does positively impact health in healthy older adults, and that the participants honestly and accurately reported the state of their own health and put forth their best effort during the study.

## 1.8 Definition of terms

To follow is an overview of the main terms used in this thesis. More in-depth definitions for each of these terms, along with terms of lesser importance, are found throughout the thesis.

- International Poi: the style of poi practiced outside of Māoridom. It is an umbrella term which encompasses many different types of International Poi and ways of moving. All types of International Poi consist of swinging a weight on the end of a cord in circles, with no specific cultural context or meaning.
- Māori Poi: the style of poi practiced by the Māori of New Zealand. It is an umbrella term which encompasses many different types of Māori Poi, ways of moving with the poi, and cultural significance. All types of Māori Poi consist of swinging a weight on the end of a cord in circles, within the cultural context of Māoridom.
- Health: “a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity” (World Health Organization, 2015 pg. 228).

- Healthy older adult: someone aged 60 or older who does not have any neurological disorders, musculoskeletal disorders, and/or dizziness or faintness during physical activity.
- Physical health: health related to the body. It was measured by the Functional Reach Test (balance), 4-Stage Balance Test (balance), circle tracing (bimanual coordination), blood pressure, pinch grip, hand grip, heart rate, 30 Second Chair Stand Test (lower body strength), 9-Hole Peg Test (manual dexterity), and upper limb (wrist, elbow, shoulder) range of motion.
- Cognitive health: health related to the brain. The following domains were measured via a computerized test battery: simple and complex attention, cognitive flexibility, executive function, motor speed, processing speed, psychomotor speed, reaction time, verbal memory, visual memory, composite memory, and the overall neurocognition Index (NCI).
- Emotional health: health related to psychological wellbeing. It was measured by the 36-Item Short Form Survey (SF-36), a patient-reported survey which is often used as a measure of health-related quality of life.

## 1.9 Thesis overview

This thesis consists of six chapters as follows.

- Chapter 1 provides an overview of the research context, aims, significance, methodology, limitations, and key terms.
- Chapter 2 reviews the literature on ageing, poi, and Tai Chi in relation to physical, cognitive and emotional health in healthy older adults.
- Chapter 3 details and justifies the methodology and methods which guided this study.
- Chapter 4 reports the clinical study and follow-up questionnaire results.
- Chapter 5 discusses the findings and methodology of the clinical study and questionnaires.

- Chapter 6 presents implications for future research, policy, and practice.

## 2. Review of literature

### 2.1 Chapter overview

The first section of this chapter begins with an overview of ageing, followed by some important definitions within this area. It proceeds to a contextualizing overview of paradigms of ageing, and a brief discussion of the theoretical framework for teaching and learning with adults on which this study is based. This is followed by a review of scholarly research related to ageing and physical, cognitive and emotional health in healthy older adults. A review of literature on ageing was carried out to provide a foundation and context for the choices made in this thesis regarding its sample of healthy older adults. Second is a discussion of the current literature on poi; more specifically an account of the origins and evolution of poi along with a comparison of Māori and International Poi styles. A review of poi was carried out to provide a historical, cultural, and conceptual backdrop for the present study. Third is a review of Tai Chi in relation to physical, cognitive, and emotional health in healthy older adults. A review of Tai Chi was conducted as Tai Chi was one of two activities most closely related to International Poi (see Chapter 3), and was the activity ultimately chosen for the control group.

### 2.2 Ageing

#### 2.2.1 Introduction

Ageing, at a biological level, is the result of molecular and cellular damage that occurs over time. This damage weakens the immune system and the body's ability to repair itself, and increases the risk of disease (World Health Organization, 2015). In addition to biological changes, we experience many

social and emotional changes as we age which may impact our health, such as the loss of close relationships and shifts in social roles (World Health Organization, 2015).

We are currently experiencing unprecedented population ageing worldwide, with older adults projected to outnumber youth for the first time in history (World Health Organization, 2017a). The causes of disability and death are currently shifting. Acute diseases are waning, and chronic and degenerative diseases, which are persistent or have long-lasting effects, are now at the helm of disability and death for older adults (National Institute on Aging, 2011). Currently, for women who are 60 years or older, these conditions are unipolar depressive disorders, hearing loss, back and neck pain, Alzheimer's disease and other dementias, and osteoarthritis. For men, they are hearing loss, back and neck pain, falls, chronic obstructive pulmonary disease and diabetes mellitus (United Nations, 2015).

As we increase our lifespan and the pervasiveness of chronic disease also increases, one consideration of utmost importance is quality of life. As Parker and Thorslund (2007) state, "As the average expected life span increases, an important issue is whether the years added to life are characterized by good health and independence or by health problems and the need for care" (p. 151). It is crucial to address this question, as poor quality of life not only impacts individual wellbeing, but that individual's ability to contribute to his or her family, local community, and society more broadly, along with creating an increased demand for health care to prevent and treat chronic conditions (World Health Organization, 2015).

The following section will first define some terms which are specific to ageing, then discuss gerontological paradigms, andragogy, and review the scholarly literature on ageing and physical,

cognitive, and emotional health. This section strives to provide a general foundation and context for the decisions made throughout this thesis.

## 2.2.2 Definition of terms

- Ageing: at a biological level, ageing results from the impact of the accumulation of a wide variety of molecular and cellular damage that occurs over time (World Health Organization, 2015 pg. 225).
- Chronic condition: a disease, disorder, injury or trauma that is persistent or has long-lasting effects (World Health Organization, 2015 pg. 226).
- Functioning: an umbrella term for body functions, body structures, activities and participation; it denotes the positive aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors (World Health Organization, 2015 pg. 227).
- Gerontology: the study of the social, psychological and biological aspects of ageing (World Health Organization, 2015 pg. 227).
- Wellbeing: a general term encompassing the total universe of human life domains, including physical, mental and social aspects, that make up what can be called a "good life" (World Health Organization, 2015 pg. 231).

## 2.2.3 Paradigms

"...we will grow old, in part, by what we take old age to be" (Ryff, 1986, p. 52).

As the ageing population continues to rapidly increase, we stand on the precipice of a new gerontological paradigm. Age old (no pun intended) characteristics of universality and negativity in theories of ageing are being replaced with new trends of individualism and positivity. Some of the most widely used theories of gerontology, such as active ageing, and the successful ageing standards established by Rowe and Kahn (Rowe & Kahn, 1998), have been criticized for excluding and/or disregard individual and cultural differences (Paúl, Ribeiro, & Teixeira, 2012). For example, a study by Strawbridge, Wallhagen, and Cohen (2002) compared the prevalence and characteristics of older adults who self-reported ageing successfully versus those that classified according to Rowe and Kahn's 1998 criteria:

When asked to classify their own status, 50.3% of the participants rated themselves as ageing successfully compared with 18.8% obtained by applying Rowe and Kahn's three rather stringent criteria: (a) absence of disease, disability, and risk factors; (b) maintaining physical and mental functioning; and (c) engagement with life. This large difference is interesting in itself, because it indicates that a much higher proportion of older persons consider themselves to be ageing successfully than is indicated by the most popular definition proposed by health professionals. (p. 732)

These contradictions are being addressed by new theories such as Gerotranscendence.

Gerotranscendence suggests that there is continuous development in old age, with its own meaning and set of values (Tornstam, 2005). It posits that old age is not a repetition of the patterns of one's younger self, but rather a transformation characterized by new ways of understanding life. This theory has caused controversy, and questions around if gerotranscendence is really age-related, and if it is really universal rather than dependent on culture or personality (Jewell, 2014).

While a much deeper look could be taken into theories on ageing, it is sufficient to say that the present study situates itself within the current trends in the discussion on ageing, such as regarding ageing with a positive attitude, taking cultural differences and individuality into consideration, and focusing on quality of life rather than longevity (Bengston & Settersten, 2016). In the near future, it is

likely that it will fit into a specific framework within the new gerontological paradigm that has yet to emerge.

## 2.2.4 Teaching and learning framework

Although this study does not measure learning, but rather physical, cognitive, and emotional effects (in the clinical study) and participant perceptions (in the follow-up questionnaires), its methodology does incorporate a teaching-learning process for the introduction of International Poi and Tai Chi to the study sample. Thus, it is important to explicate the theoretical framework on which this process was based. It should be noted that detailed descriptions of the instructors, learners, and lesson content are included in Chapter 3.

Learning plays an important role in ageing, and it can facilitate participation in society and better quality of life (Boulton-Lewis, 2010). Andragogy is a term used to distinguish adult education from pre-adult education (pedagogy), though there is ongoing debate over whether the assumptions set forth are characteristic of adults only (Knowles, 1980; Merriam, 2001). This study follows the andragogical principles espoused by Malcolm Knowles, that is, the individual learner (in this case adult learner) is autonomous, free, and growth-oriented (Knowles, 1980). More specifically, Merriam (2001) suggests,

The five assumptions underlying andragogy describe the adult learner as someone who (1) has an independent self-concept and who can direct his or her own learning, (2) has accumulated a reservoir of life experiences that is a rich resource for learning, (3) has learning needs closely related to changing social roles, (4) is problem-centered and interested in immediate application of knowledge, and (5) is motivated to learn by internal rather than external factors. (p. 5)

This approach, coupled with an active learning methodology, provided the theoretical framework for the International Poi and Tai Chi lessons in the present study. Active learning is an instructional

method which actively engages students in the learning process. Students are engaged in two ways, by doing things and by thinking about the thing they are doing (Prince 2004). Active learning may take on different meanings and be implemented to different degrees depending on the subject and the learners (Kane, 2004).

In addition to the poi and the Tai Chi lessons taking an active learning approach within the framework of andragogy, equal value was placed on the learner, the teacher, and the content (Lusted, 1986). Thus, the teaching-learning framework on which this thesis is based is situated squarely within the domain of critical pedagogy and rejects the traditional banking metaphor of education (wherein learners are filled up like piggy banks) which was so aptly critiqued by the famous adult educator and philosopher Paulo Freire in his seminal work *Pedagogy of the Oppressed* (Freire, 1970).

## 2.2.5 Ageing and physical health

Physical health is dependent on physical functioning, or a person's capacity to undertake the physical tasks of everyday living (Cooper et al., 2010). One important aspect of maintaining physical health and functioning is physical activity, or “any bodily movement produced by skeletal muscles that requires energy expenditure” (World Health Organization, 2017b). Physical activity is a broad term, which encompasses not only planned out exercise (of which the primary objective is to improve or maintain physical fitness) but also other activities which involve bodily movement such as work, chores, active transportation, and other recreational activities (World Health Organization, 2017b). The literature on ageing, physical health, and older adults is vast. When conducting a title search for the terms “physical health” and “ageing” OR “ageing” OR “elderly” OR “older”, PubMed returned 219,313 results. Limiting these results to reviews of literature conducted in the past decade still yielded over 400 results. The following section will draw upon the most relevant literature to this thesis, that is,

literature focused on the systematic review of physical health at large (as opposed to a specific aspect of physical health) and healthy older community dwelling adults (as opposed to the oldest old, those with chronic disease, etc.).

The need for regular physical activity is extremely important later in life, and maintaining physical health can decrease the risk of morbidity and all-cause mortality (all of the deaths that occur in a population, regardless of the cause) (Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016; Cooper et al., 2017; Paterson, Jones, & Rice, 2007; Sun, Norman, & While, 2013; World Health Organization, 2010). Some of the benefits of physical activity for older adults include lower rates of all-cause mortality, morbidity, coronary heart disease, high blood pressure, stroke, type 2 diabetes, colon cancer, breast cancer, higher levels of cardiorespiratory and muscular fitness, and extending years of active independent living (Bauman et al., 2016; Cooper et al., 2017; Paterson et al., 2007; Sun et al., 2013; World Health Organization, 2010). Arguably, increasing physical activity is the most important intervention for enhancing population health, given that a large portion of the global population is inactive (Patterson et al., 2007). Objective measures of physical health may also play an important role in acting as markers for future health (Cooper et al., 2010).

While it is clear there are many important benefits to be gained from physical activity, the literature calls for further rigorous research. There is limited data regarding the proportion of older adults who met the World Health Organization physical activity guidelines (Sun et al., 2013). Some key components of physical activity, such as strength and balance, are rarely monitored at the population level or included in public health strategies to promote physical activity to older adults (Bauman et al., 2016). In addition, further research needs to be conducted on the associations between physical health and subsequent health problems (Cooper et al., 2010). Increasing physical activity is not just an

individual problem, but a societal problem, and thus will require a multidisciplinary and culturally relevant approach (World Health Organization, 2017b).

This thesis aligns itself with the current literature on physical health and older adults, and rests on the assumption that regular physical activity is critical in our later years. Despite the importance of regular physical activity for maintaining health in old age, older adults represent the most sedentary segment of our population (“Physical Activity Guidelines”, 2008). Thus, this thesis examines two physical activities as interventions, Tai Chi and International Poi. Both activities are cost effective, can be done anywhere, and can be done alone or in a group. These factors make both activities easy to incorporate into daily life, which means they are more likely to have a greater impact on older adults (King, Rejeski, & Buchner, 1998). In addition, Tai Chi is appropriate for older adults as it is considered a light to moderate intensity activity, depending on the style (Lan, Chen, Wong, & Lai, 2013). While there is no literature on the activity level of International Poi we can assume, based on the activity itself and the definitions to follow, that poi is also a light to moderate activity. The intensity level of an activity is determined using metabolic equivalents of task (METs), or the energy cost to the individual (Ainsworth et al., 2011). Light intensity activities (<3 METs) require the least amount of effort, compared to moderate and vigorous activities, and include things like leisurely walking or light housework (Bann et al., 2015). Moderate intensity activities (3-6 METs) are aerobic activities which increase heart rate and breathing to some extent (“Physical Activity Guidelines”, 2008).

Light intensity activities are especially important for older adults, as they often find it difficult to initiate or maintain moderate to vigorous activities, and spend a greater portion of their day partaking in light intensity activities than any other age group (Bann et al., 2015; Buman et al., 2010). There is a paucity of rigorous research and objective measures of light physical activity for older adults, and

further research is warranted as these activities appeal to and are feasible for older adults (Buman et al., 2010). This thesis aims to contribute to said literature, thus along with examining two forms of exercise appropriate for older adults, a battery of physical tests was included in the clinical study measures (see Chapter 3). A questionnaire was also developed specifically to assess participants physical activity level prior to beginning the study, in order to better understand if physical improvements seen in the present study were due to the specific interventions, or due to increased physical activity in general (see Chapter 3).

In conclusion, regular physical activity is extremely important later in life, and maintaining physical health can decrease the risk of morbidity and all-cause mortality. The methodological considerations of the present study have been informed by the literature on physical health and healthy older adults, in that two light to moderate physical activities which are cost effective, can be done anywhere, and can be done alone or in a group, were chosen for the intervention. This thesis aims to contribute to the literature on physical activity and healthy older adults.

## 2.2.6 Ageing and cognitive health

Maintaining cognitive health in old age is partially dependent on neuroplasticity, which is “the ability of the brain to adapt to an environmental change by modifying neural connectivity and brain function in response to changing demands and environments throughout the lifespan” (Ballesteros, Kraft, Santana, & Tziraki, 2015. p. 454). Research has shown that even in old age, the brain can maintain its plasticity, or its capacity to change its structure and function (Boyke, Driemeyer, Gaser, Büchel, & May, 2008). The literature on ageing, cognitive health, and older adults is vast. When conducting a title search for the terms “cognitive health” and “ageing” OR “ageing” OR “elderly” OR “older” PubMed returned 177,664 results. Limiting these results to reviews of literature conducted in the past

decade yielded over 300 results. The following section will draw upon the most relevant literature to this thesis, that is, literature focused on the systematic review of cognitive health or function at large (as opposed to a specific aspect of cognitive health) and healthy older community dwelling adults (as opposed to the oldest old, those with chronic disease, etc.).

There is a lack of well-designed quantitative research on maintaining cognitive health in healthy older adults (Ballesteros et al., 2015; Depp, Harmell, & Vahia, 2011; Naqvi, Liberman, Rosenberg, Alston, & Straus, 2013). There are many interventions, products, and programs targeted at preventing cognitive decline, ranging from physical and cognitive programs to prescription and nonprescription medications, but the evidence to support them is sparse and often conflicting (Naqvi et al., 2013). Studies need to control for the selection of participants more closely, recruit larger samples, and include two control groups (an active and a non-contact group) to help mitigate placebo effects and the effects of social contact with the experimenters (Ballesteros et al., 2015).

While it is clear more rigorous research is necessary, it is also clear that the ageing brain still displays plasticity, and many interventions show promise for maintaining or improving cognitive function in old age (Ballesteros et al., 2015). These interventions include physical activity (such as dance, Tai Chi, and aerobic exercise), cognitive training, caloric restriction/dietary influences, social interventions, and multi-domain interventions which blend multiple approaches (Ballesteros et al., 2015; Depp et al., 2011; Naqvi et al., 2013). This thesis aligns itself with the current research on cognitive health and older adults, and rests on the assumption that cognitive function can be maintained or improved in old age. Thus, when determining the control group for the clinical study, one criteria was the activity must have a cognitive dimension and require a higher level of thinking to achieve (see Chapter 3). Tai Chi, the activity ultimately chosen for the control group, can be considered a meditation in motion

(Kuramoto, 2006). In addition to being a physical exercise, “Tai Chi also exercises the mind through memorization of sequences of postures, concentration, and meditation” (Miller & Taylor-Piliae, 2004, p. 10). There is some evidence that Tai Chi improves cognitive function, but further rigorous research is warranted (Miller & Taylor-Piliae, 2014; Wayne et al., 2014). There is no research on International Poi and cognitive health, though this thesis posits that poi can also be considered a meditation in motion, blending physical movement and focused awareness. This is further discussed in the Play, Meditative Movement, and Flow State section of this chapter. A goal of the present study is to add to the literature on cognitive health and healthy older adults, thus not only were two activities with a cognitive dimension chosen for the intervention, but a battery of cognitive tests were included in the clinical study measures (see Chapter 3).

In conclusion, the ageing brain still displays plasticity and many interventions show promise for maintaining or improving cognitive function in old age, though further well-designed quantitative research in this field is warranted. The methodological considerations of the present study have been informed by the literature on cognitive health and healthy older adults, in that two activities which require a certain level of cognitive engagement were chosen for the intervention, and cognition was measured during the clinical study using a standard battery of cognitive tests. This thesis aims to contribute to the literature on cognitive health and healthy older adults.

### 2.2.7 Ageing and emotional health

Wellbeing is “a general term encompassing the total universe of human life domains, including physical, mental and social aspects, that make up what can be called a ‘good life’” (World Health Organization, 2015 pg. 231). Promoting wellbeing, in general, is a fundamental and universal goal:

The promotion of individual wellbeing is a central goal of virtually all modern societies, and of many units within them. While there are real and important differences of opinion - both within societies and between them - about *how* individual wellbeing is to be maximized, there is nearly universal agreement that the goal itself is a worthy one and is to be actively pursued. (Andrews & Withey, 1976, p. 7)

The literature on ageing, emotional health, and older adults is vast. When conducting a title search for the terms “emotional health” and “ageing” OR “ageing” OR “elderly” OR “older” PubMed returned 177,657 results. Limiting these results to reviews of literature conducted in the past decade yielded less than 100 results. The following section will draw upon the most relevant literature to this thesis, that is, literature focused on the systematic review of emotional health at large (as opposed to a specific aspect of emotional health) and healthy older community dwelling adults (as opposed to the oldest old, those with chronic disease, etc.).

Wellbeing and health are closely related, perhaps even more so at old age with the increasing prevalence of chronic disease (Depp et al., 2010; Steptoe, Deaton, & Stone, 2015). The boom in our ageing population will have far reaching consequences, and promoting wellbeing is a primary concern. As noted by the United Nations 2013 ageing report:

Ageing has profound consequences on a broad range of economic, political and social processes. First and foremost is the increasing priority to promoting the wellbeing of the growing number and proportion of older persons in most countries of the world. (p. 1)

Emotional and cognitive health may have increasing importance in the future, as nearly all older adults will experience chronic disease. While avoiding this is probably not a feasible goal, developing cognitive and emotional adaptations to these diseases may be possible (Depp et al., 2010). After all, the characteristics of successful ageing as described by older adults are largely psychological constructs, rather than physical (Depp et al., 2010). That being said, there is a lack of quantitative

research on subjective wellbeing and the emotional components of ageing (Depp et al., 2010; Steptoe et al., 2015).

The question of how to promote emotional health and wellbeing is one of continual examination and exploration. Most of our knowledge around this issue comes from longitudinal population cohort studies, and “we do not yet know whether wellbeing is sufficiently modifiable by psychological, societal, or economic interventions to test effects on health outcomes” (Steptoe et al., 2015, p. 646). Just as there is no “typical” older person, there is no standard way to approach an individual’s emotional health. Further rigorous research is called for and healthcare systems should not only be concerned with physical illness and disability, but with emotional health and methods to improve positive psychological states (Steptoe et al., 2015).

This thesis aligns itself with the current research on emotional health and older adults, which emphasizes the importance of promoting individual wellbeing. Tai Chi, the control group activity of the present study, is intended to enhance inner harmony, balance, and general health and wellbeing (Jahnke, 2002). Poor health is viewed as an imbalance between yin and yang in Confucian and Buddhist philosophy, and Tai Chi can be used as a tool for re-balancing the yin and yang energy (Ernst, Pittler, Wider, & Boddy, 2008). Tai Chi has a myriad of positive effects on well-being such as reduced anxiety, depression, and mood disturbance, and improved self-esteem, though further rigorous research on Tai Chi and wellbeing is warranted (Frye, Scheinthal, Kemarskaya, & Pruchno, 2007). There is no known literature on International Poi and emotional health in healthy older adults, though there are countless personal stories about the positive impact of poi on emotional wellbeing (see the Comparing Māori and International Poi section later in this chapter for excerpts of personal accounts). The present study aims to fill a gap in the literature regarding International Poi, Tai Chi, and emotional

wellbeing, through the clinical study data and follow-up questionnaires aimed to capture participants reactions to the intervention (see Chapter 3). This data may allow us to gain a richer understanding of the effect, or the perceived effect, of the intervention on emotional health.

In conclusion, promoting individual well-being is of utmost concern. There is a lack of quantitative research on subjective wellbeing and the emotional components of ageing, though wellbeing and health are believed to be closely related. The methodological considerations of this thesis have been informed by the literature on emotional health and healthy older adults, in that activities which are intended to improve wellbeing were chosen for the intervention, and emotional health was measured quantitatively during the clinical study and with follow-up questionnaires. This thesis aims to contribute to the literature on emotional health and healthy older adults.

## 2.2.8 Summary

The section has reviewed relevant literature on physical, cognitive, and emotional health and healthy older adults. Though these categories are often intertwined, they were discussed separately as the methodology and protocol for the present study addresses them separately. Regarding physical health, regular physical activity is extremely important later in life, and maintaining physical health can decrease the risk of morbidity and all-cause mortality. The methodological considerations of this thesis have been informed by the literature on physical health in that poi and Tai Chi are light to moderate physical activities which are cost effective, can be done anywhere, and can be done alone or in a group. Physical health was measured during the clinical study using a battery of standard tests. In regard to cognitive health, the ageing brain still displays plasticity and many interventions show promise for maintaining or improving cognitive function in old age, though further well-designed quantitative research in this field is warranted. The methodological considerations of this thesis have

been informed by the literature on cognitive health in that poi and Tai Chi require a certain level of cognitive engagement, and cognition was measured during the clinical study using a standard battery of cognitive tests. Regarding emotional health, promoting individual well-being is of utmost concern. There is a lack of quantitative research on subjective wellbeing and the emotional components of ageing, though wellbeing and health are believed to be closely related. The methodological considerations of this thesis have been informed by the literature on emotional health in that poi and Tai Chi are intended to improve wellbeing, and emotional health was measured through the clinical study and with follow-up questionnaires. This thesis aims to contribute to the literature on physical, cognitive, and emotional health and healthy older adults. To follow is a review of the scholarly literature on poi and Tai Chi.

## 2.3 Poi

### 2.3.1 Introduction

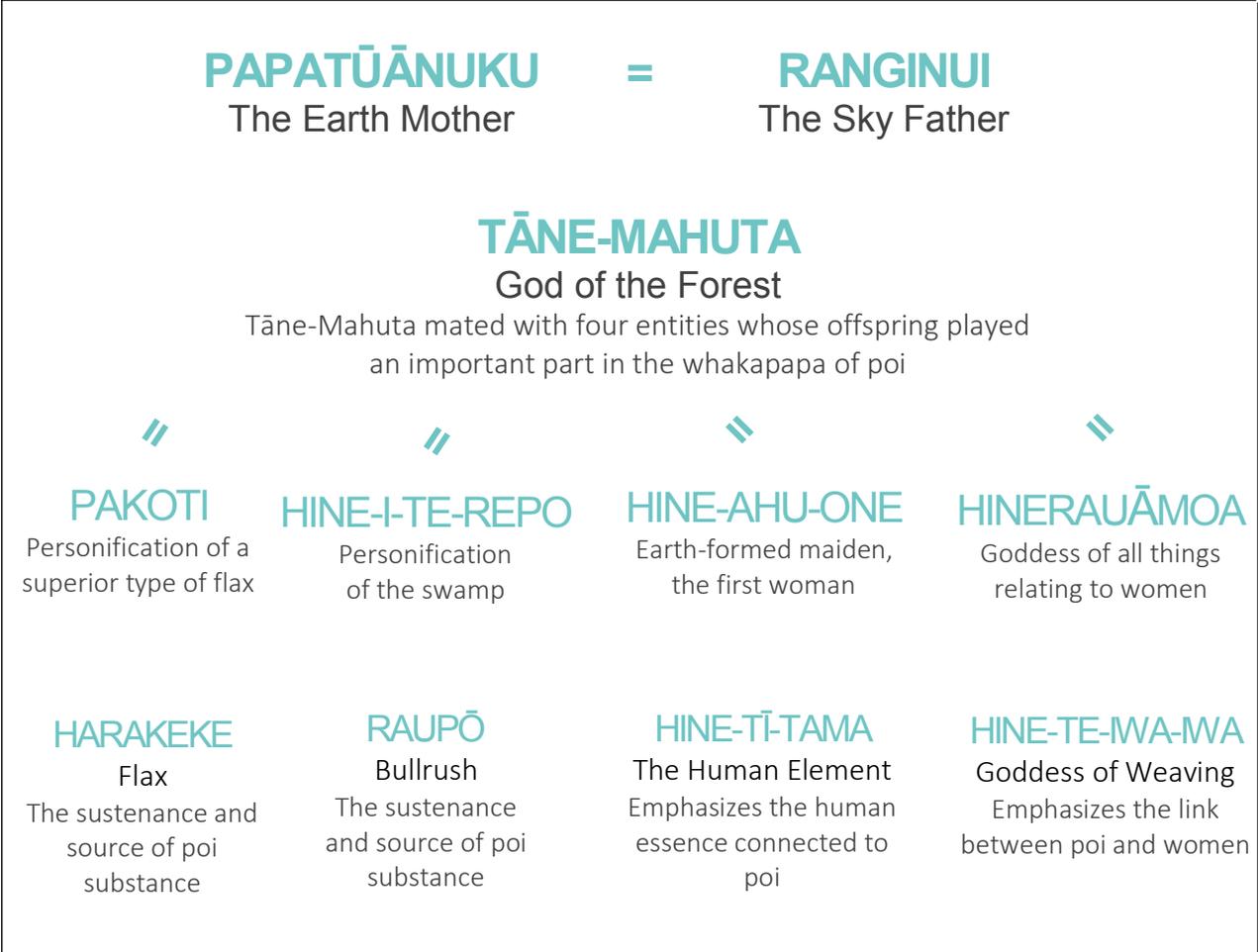
Poi is both an object (a weight on the end of a cord), and the act of swinging that object in circular patterns around the body (Paringatai, 2009). The word itself is Māori, and translates into “ball” (Huata, 2000). If we move beyond this pragmatic definition, and attempt to describe the meaning behind the object and how it is used, defining poi becomes quite a challenge. There are a vast number of poi styles, many of which boast their own terminology, context, and cultural implications. For the purposes of this thesis, two overarching styles will be discussed: the style practiced exclusively by the Māori in New Zealand (here termed Māori Poi), and the style practiced by everyone else (here termed International Poi). These terms were chosen as they directly reflect the population which takes part. For the purposes of this thesis, the assumption that International Poi has roots in Māoridom will be made. Therefore, it is important to examine poi within and outside of Māoridom in further depth.

The following section will begin by discussing the origins and evolution of poi. It will then compare and contrast Māori and International poi styles. It will conclude with a discussion on play, meditative movement, and flow state. There is no known literature in the field of poi, health, and older adults, and in fact there is a lack of scientific research on any aspect of Māori or International Poi. Therefore, the following section will not only draw upon academic literature, but also memoirs and personal communications.

### 2.3.2 Origin and evolution

To understand how Poi became, we have to go back to the beginning. The Māori believe that the whakapapa of the Poi is the starting point and tells the story of the creation of Poi in its purest form. For without the divine creators everything around us would cease to exist, even Poi. (Taylor, 2007, p. 9)

Māori pūrākau, or creation stories, explain the creation of the world, the gods, humanity, and thus, poi. They are not considered myths or tales, but rather preserved ancestral knowledge (Lee, 2005). According to Te Ara, the Encyclopedia of New Zealand, there are many versions of the Māori creation story, though most describe movement from Te Kore (nothingness) to something, and from Te Pō (darkness) to Te Ao (light) (Royal, 2012). Some versions, such as the one in Ngāmoni Huata's (2000) book, also include Io, the great creator. Out of the darkness (or from Io, depending on the version), Papatūānuku and Ranginui emerged. Below is the whakapapa (genealogy) of poi from the emergence and union of Papatūānuku and Ranginui. The whakapapa references work by Huata (2000), Paringatai (2009), and Taylor (2007).



*Figure 1. Māori Poi whakapapa*

By understanding this genealogy, we can begin to understand how Māori relate to, live through, and are one with poi. As Ngāmoni Huata (2000) states, “Poi embodies whakapapa and the connection to the land and continuity of the culture through growth, hence the spiritual existence of poi is rooted in the beginnings of time” (p. 23). The importance of the poi’s whakapapa is carried through every aspect of Māori Poi, and in order to practice Māori Poi one must understand many larger Māori concepts along with understanding, and being able to execute the poi actions, steps, and songs. Angie Smith, arguably one of New Zealand’s leading Māori Poi exponents (P. Sharples, personal communication, July 22, 2015) stated, “If [Māori Poi] was to be used worldwide, it would only be if people understood the depths of what that’s about” (A. Smith, personal communication, December 12, 2016).

One integral aspect of Māori Poi is music. Poi actions are typically created to reflect and depict the words of a song. Angie Smith says “...everything about poi starts from the word” (A. Smith, personal communication, December 12, 2016). Poi is also innately rhythmic. As Huata beautifully states, “Rhythm represents the life of poi” (p. 138). In addition to the rhythmic nature of poi, and the songs that generate and accompany poi actions, the poi object itself can create music when hit on the body. The structure of the poi ball can produce different pitches and sound qualities. There are also “visual poi” or “unpitched” poi, which do not come into contact with a surface and are therefore only seen and not heard (Huata, 2000).

Poi outside of Māori culture is believed to have originated from Māori Poi, but there is no known record of how this transition might have taken place. Poi outside of Māoridom does not have specific cultural ties or significance as it does within Māoridom, though it can be connected to different sub-cultures across the world (i. e. circus, rave, festival). As Nick Woolsey (2017), an International Poi exponent, states:

Poi was popularized throughout the world largely through the performance art of fire spinning, which is not part of Māori tradition or culture. Nobody seems to know who first invented “fire poi,” or when it happened. This new version of poi was only loosely based on traditional Māori poi, and quickly evolved as it spread around the world. Enthusiasts invented new moves and borrowed heavily from other disciplines, such as juggling, club swinging, dance, and rhythmic gymnastics. Yet the name “poi” stuck. (para 4)

Some International Poi artists believe there are two broad categories of International Poi movement style: classic or dance or older style, and technical poi (N. Woolsey, personal communication, October 4, 2017; T. Goddard, personal communication, October 9, 2017). These styles are influenced by a number of factors including region of training, poi equipment, and the artists themselves (T. Goddard, personal communication, October 9, 2017). Classic style encompasses the early developments and

foundations of poi, with moves such as weaves, fountains, reels, and basic flowers. Classic style is predominantly focused on the movement or flow of the body, with poi as an expressive extension of that movement. Technical style is an expansion of classic style, exploring existing moves, concepts, and frameworks in greater depth. Technical poi is predominantly focused on pushing the boundaries of the poi moves themselves, and is rooted in theory in order to systematize progress and possibilities. Within these styles, there are many different types of poi props (e.g. contact poi, fabric poi, even weighted poi), which lend themselves to different types of movements (T. Goddard, personal communication, October 9, 2017). This study situates itself within the classic style of poi movement and equipment, as the study is focused on the fundamental act of moving a weight on the end of a cord in circular patterns, and the effect that this basic motion has on health.

Academic literature on International Poi is sparse. There are three articles about International Poi as a tool for digitally manipulating sound and/or visuals (Nam, Kim, Martinson, & Helmuth, 2013; Riegle van West, 2011; Sheridan, Bayliss, & Bryan-Kinns, 2006), and one article about the mathematics of poi (Farrington, 2015). Beyond poi being the primary subject, this literature is not relevant to the present study and does not add substantial context, meaning, or insight. The only other known piece of rigorous research on International Poi is a mixed methods study by Loris Sirs (2017) entitled *Examining the Impact of Poi-spinning on the Development of Self-regulation in Children and Adolescents*. The study examined the effects of poi on self-regulation, or the ability to control our own behavior, emotions, or thoughts. The study also assessed the effects of poi on therapeutic alliance, or the relationship between the health care professional and the patient. The following means of measuring were used before and after the intervention, which consisted of a minimum of 10 counseling sessions in which poi was used as a modality:

- Behavior Assessment System Checklist, 2nd Edition (BASC-2): measured behavioral and emotional functioning ;
- Child Outcome Rating Scale (CORS) and Outcome Rating Scale (ORS): measured overall quality of life; and,
- Child Session Rating Scale (CSRS) and Session Rating Scale (SRS): helped participants rate the effectiveness of their therapy sessions as well as therapeutic alliance.

In addition, semi-structured interviews were conducted during counseling sessions, both when poi had and had not been used in the session. The following questions were asked: When do you know it is a good time to spin poi outside of the therapy office? What do you like or not like about poi spinning? How do you feel when you are done spinning poi? Is there anything else you would like to share about your experience with poi spinning?

Sirs study showed positive outcomes on self-regulation through the BASC-2. Improvement was seen in all composite scores, including School Problems, Internalizing Problems, Inattention/Hyperactivity, Adjustment, and Emotional Symptoms Index composite scores. Regarding therapeutic alliance, means scores from the CSRS and SRS were compared for sessions which involved poi and sessions which did not, using an independent single-tailed T-test. Results were significant, with  $t(43) = -2.18, p = 0.017$ . This is in contradiction to self-reported satisfaction, which was lower for sessions that used poi as a modality. Thematic analysis of the interview questions revealed three themes: enjoyment, calming effect, and mood regulation. Unfortunately, the limitations of this study make it difficult to draw any meaningful conclusions. The sample size was 4 participants; and the BASC-2 analysis only included 3 participants. Poi was not the only modality employed during the sessions, and some participants were receiving additional interventions concurrently, making it difficult to discern the role of poi in the outcomes. The researcher also notes that children with Autism Spectrum Disorder “can show

variability in symptomatology that is not correlated to treatment interventions at all” (Sirs, 2017, p. 22). While it is exciting to see research in the field of poi and health, the limitations of this study loom large. Further, methodologically sound research is warranted.

### 2.3.3 Comparing Māori and International Poi

Both Māori and International Poi styles have many intricacies and complexities, as examined above, and as such there is value in outlining the fundamental differences and similarities between the two styles. The information in the “Māori Poi” column is primarily drawn from three texts (Huata, 2000; Taylor, 2007; Paringatai, 2009) and from the researcher’s conversations with Māori Poi artists in New Zealand. The information in the “International Poi” column is drawn from the researcher’s 15 years of personal experience, online articles, and numerous informal conversations with dozens of International Poi artists over the past decade.

MĀORI POI AND INTERNATIONAL POI COMPARISON		
<i>Differences</i>		
	<b>Māori Poi</b>	<b>International Poi</b>
<i>Object</i>	poi ball is relatively light	poi ball has significant weight
	poi are primarily short (approx. 25cm) or long (approx. 73cm)	poi are of no specific length
	poi is typically a foam ball covered in plastic with a woven yarn string (early poi have the same design but use different materials such as flax)	poi can be almost any material, including kevlar fire poi, LED glow poi, silicon contact poi, and cloth practice poi
<i>Practice and Performance</i>	practiced and performed primarily by women	practiced and performed by both sexes
	practiced and performed primarily in groups	practiced and performed primarily alone

<i>Moves/Actions</i>	actions, and their relation to the body, have specific cultural meanings and are used to tell stories	moves have no specific meanings
	the types of actions are primarily determined by how well they represent a symbol or element of a cultural story	types of moves are determined by the poi spinner, and are based on their own style and what feels good to them
	because actions primarily represent cultural elements, the repertoire of actions is relatively small and the evolution of actions is slow	because there are no limitations on moves, and poi spinners are interested in pushing the boundaries, there is a quick evolution and large repertoire of moves
	poi can be hit against the body to produce a percussive sound	poi are generally not hit against the body to produce a percussive sound, though some poi styles incorporate wraps and hits
<i>Accompaniment</i>	primarily accompanied by live song and/or the percussive sound of the poi hitting the body	primarily done silently or accompanied by pre-recorded music
	primarily accompanied by specific steps	no specific steps, moving is completely determined by the poi spinner
<i>Purpose</i>	originally used primarily by men for strength and dexterity training, by women for entertainment, and as a cultural messenger/storyteller	originally used primarily for play and performance art
	currently used primarily as a cultural messenger/storyteller, and for sport/entertainment through kapa haka	currently used primarily for play and performance art
<i>Terminology*</i>	a person who practices poi does not have a specific term	a person who practices poi is most commonly called a poi spinner
	the act of practicing poi does not have a specific term	the act of practicing poi is most commonly called spinning poi
	the skills you demonstrate with poi are most commonly called actions	the skills you demonstrate with poi are most commonly called moves or tricks

<i>Similarities</i>
Poi is comprised of a flexible cord with a weight on the end which is spun in circles
The basic actions or moves are almost identical, and many share the same name (for example figure 8, butterfly, windmill)
The number of poi most commonly used by an individual is 2, though 1, 3 and 4 poi are also used

\* *The terminology in the International Poi column was determined through an online survey (Appendix A)*

*Table 1. Māori Poi and International Poi comparison*

One of the primary differences between International Poi and Māori Poi is the root and meaning of the actions/movements, and how those movements are chosen as part of one's poi repertoire. In International Poi style, movements are primarily chosen based on the individual poi artists' desires. Individuals bring their own background, and create their own meaning, with and through their poi. Because the meaning of International Poi varies vastly depending on the individual using them, no specific meaning can be attributed to the movements. When discussing the meaning behind International Poi, Māori Poi exponent Angie Smith explained:

There is movement there, there is technical skill [with International Poi]. Over here [with Māori Poi] it's the same, but then you drill down, and there's a whole whakapapa. This poi here has a genealogy that goes back to the myths of time. There's a depth that we think that Māori poi has. We don't know the whakapapa of that other poi, and we're not thinking that there is one. With [International] Poi, where does it come from, what are you wanting it to be, what's the explanation in all your moves? (A. Smith, personal communication, December 12, 2016)

Because there is no known whakapapa, or genealogy, of International Poi, the meaning and depth is left solely to the individual poi spinner. Below are a few quotes from International Poi artists which paint a picture about poi's multifaceted meaning and importance.

...there's not a single day that I haven't wanted to be poi-ing; I carry extra sets to give to anyone who finds it interesting, I use it to relax in the morning, I go to bed after practising. It's

become who I am. It's taught me how to hold my posture, flow to music, given me something to give back to the world, helped me meet and become friends with hundreds of other people who spin, shown me a confidence in myself that helps in any other situation, and brought a harmony in my household because now we're all spinning. (R. Brenton, personal communication, July 12, 2015)

[Poi] allows me to discard my mood, worries, hunger, sadness, everything. Words don't really do justice to what I owe this community and those two twirling socks, but; Poi = Happy. (S. Norman, personal communication, July 10, 2015)

I had found a way to escape this confusing world and enter one that made complete sense to me. I felt in control, and this feeling gave me confidence. I didn't know it at the time but I found my way to meditate. I spent countless hours spinning; I didn't know many moves or tricks to start off with, but that didn't matter. I spent my time dancing with my Poi, all the while getting faster, stronger and better with each passing day. (R. McNee, personal communication, August 31, 2015)

From these excerpts we can begin to understand the different meanings and roles International Poi can play. It should be noted that Māori Poi also expresses different meanings and importance for different individuals, even though the actions have specific meanings rooted in culture. As Māori Poi exponent Ngāmoni Huata states, "For me, poi is an instrument of my own feelings and understandings. Poi can be anything you want it to be" (Huata, 2000, p. 83). In this regard, when considering poi as a tool for personal expression, Māori and International poi are very much alike.

Two other notable differences between International Poi and Māori Poi are the location of community, and groups vs. solo practice. For Māori Poi practitioners, community is based on proximity and poi is primarily a group activity. For International Poi practitioners, community is primarily based on virtual space and poi is primarily a solo activity. Even when International Poi spinners are gathered together to practice, they are typically focused on their own spinning, while of course getting advice and inspiration from those around them. There are groups who practice routines together, with synchronized choreography in a similar fashion to Māori Poi in kapa haka, but these groups are much less commonplace. Despite this, International Poi artists can be deeply

connected to a poi community, and the community can play an important role in their practice and lives. The online community of International Poi spinners is vibrant, with artists from all over the world posting and responding to hundreds of videos, questions, and poi related thoughts every day.

### 2.3.4 Play, meditative movement, and flow state

In addition to the literature on Māori and International Poi, literature in the fields of play, meditative movement, and flow state are also relevant. The aim of this section is to discuss the literature around some of the characteristics that make International Poi unique, thus providing background knowledge and insights into the decisions made in this thesis.

Play can be defined as an activity done for its own sake, with a focus on the actual experience, not accomplishing a goal (Brown, 2009). Māori Poi has been considered a form of play from the very early stages of its existence, where it is believed to have found a home in the dance section of the whare tāpere (house of entertainment) where people gathered to engage in leisure activities (Paringatai, 2004). It continues to be considered a form of play today, in both Māori and International contexts, meaning it is done for its own sake, arising out of innate motivations. Stuart Brown, Founder of The National Institute for Play, has studied and cataloged the effects of play in all stages of human and animal life to demonstrate its importance in sculpting the brain and achieving success and happiness (Brown, 2009). Specifically relating to International Poi is Brown's research on Body Play and

Movement:

Learning about self movement structures an individual's knowledge of the world – it is a way of knowing, and we actually, through movement and play, think in motion. For example the play-driven movement of leaping upward is a lesson about gravity as well as one's body. And it lights up the brain and fosters learning. Innovation, flexibility, adaptability, resilience, have their roots in movement. (Brown, 2014)

When practicing International Poi one is engaging with Body Play and Movement as described by Brown, as the poi is an extension of the body and a magnifier of our movement. Extensive research has been conducted on the role of play for children, and its value as a tool for self-expression, creativity, and learning is widely endorsed by social scientists, psychologists, educators, and health professionals (Hoppes, Wilcox, & Graham, 2011). There is considerably less research regarding how play may be beneficial to older adults. This paucity of research on older adults and play is inopportune, as play may contribute to emotional growth and maintaining cognitive function in old age (Yarnal, Chick, & Kerstetter, 2008).

Meditative movement is a relatively new category of exercise, and is often defined as “(a) some form of movement or body positioning, (b) a focus on breathing, and (c) a cleared or calm state of mind with a goal of (d) deep states of relaxation” (Larkey, Jahnke, Etnier, Gonzalez, 2009, p. 230). An early form of meditative movement that aligns with International Poi is philosopher G.I. Gurdjieff’s (1963) sacred movements. Gurdjieff was particularly interested in the way we unconsciously cycle through daily movements with our body, and how that correlates to our thoughts and emotions becoming mechanical. Gurdjieff created a system of movements intended for self-development, self-study, and breaking this loop of automatism (Azize, 2012). For example the piece “Polyrhythms” involves executing different rhythms with different limbs while making various displacements. If you embody new postures, as stated by Gurdjieff, you will “observe yourself inside differently from the way you do in ordinary conditions” (Azize, 2012, p. 310). Gurdjieff’s movements touch upon many of the important characteristics of International Poi, such as non-habitual movement, limb independence, symmetrical vs. asymmetrical movement, and a high level of concentration or focus. Though Gurdjieff, born 1866 and deceased 1949, predates the concept of “flow state” as coined by psychologist Mihaly Csikszentmihalyi (1990), the goal behind his sacred movements could certainly be

described as such. Sometimes called being in the zone, flow state is a state of concentration or complete absorption with an activity, which produces feelings of energized focus, full involvement, and enjoyment in the process of the activity being performed (Csikszentmihalyi, 1996). There are a number of different elements involved in achieving flow state, such as clear goals every step of the way, immediate feedback to one's actions, a balance between challenges and skills, merging of action and awareness, freedom from distractions, no worry of failure, self-consciousness disappears, and sense of time becoming distorted. The activity becomes an end in itself (Csikszentmihalyi, 1996). While there is no rigorous literature on poi and flow state, poi is intrinsically playful and challenging, and many poi artists across the globe recognize it as a tool for inducing flow state. Icaza (2016) provides some insight into flow arts (an umbrella term for the intersection of a variety of movement-based disciplines, including poi) and flow state. Through interviews with 11 flow artists about their experience playing with their prop, Icaza notes the following themes: harmony of skill vs challenge, complete engulfment and loss of self, loss of time and space, freedom of expression, construction of self, community, and fun. These themes fully encompass the elements of flow state, and likely represent the feelings and thoughts of flow artists worldwide which have yet to be rigorously researched and documented.

### 2.3.5 Summary

This section has discussed the origins and evolution of poi and reviewed the literature on Māori Poi, International Poi, and play, meditative movement, and flow state. There is no known literature in the field of poi, health, and older adults, and in fact there is a lack of rigorous research on any aspect of Māori and International Poi. This thesis aims to fill this gap by reporting on the systematic evaluation of the effects of poi on health through a clinical study and follow-up questionnaires. Beyond this thesis, further literature on poi in general, and on poi and health, is sorely needed.

## 2.4 Tai Chi

### 2.4.1 Introduction

While there is no research on the effects of poi on health in healthy older adults, there is research on activities which possess similar characteristics to poi such as Tai Chi, which was ultimately chosen as the control group activity for this thesis (see Chapter 3). As this thesis compares the effects of poi to the effects of Tai Chi on health, it is essential to review the literature on Tai Chi, health, and healthy older adults.

### 2.4.2 Origin and evolution

Tai Chi is the popular abbreviation for T'ai Chi Ch'üan, which can be translated as “supreme ultimate” (Kuramoto, 2006, p. 42). For the purposes of this dissertation, the popularized spelling (Tai Chi, or Tai Chi Chuan) will be used. Tai Chi developed between the 12th and 14th centuries, and is rooted in the philosophical assumption that there are two opposing life forces, yin and yang, which govern our health. Poor health is viewed as an imbalance between yin and yang in Confucian and Buddhist philosophy, and Tai Chi can be used as a tool for re-balancing the yin and yang energy (Ernst et al., 2008). Tai Chi (and Qigong, as later discussed) can also be used as preventative tools. Unlike Western traditions, where one typically waits until they are sick before they think about medical treatment, the Chinese approach considers medicine for prevention and medicine for the treatment of disease with equal weight (Jahnke, 2002). Tai Chi is a key activity for both, as it is intended to enhance inner harmony, balance, and general health and wellbeing. To practice Tai Chi, one moves through a series of flowing standing postures. Horowitz (2011) explains Tai Chi practice further:

T'ai chi has been described as a moving meditation because of its sequential flowing movements practiced with awareness and deep breathing. T'ai chi differs from other types of exercise in that its movements are generally circular and not forced, the muscles are relaxed rather than tensed, the joints are not fully extended, and connective tissues are not stretched. (p. 263)

A more detailed explanation of the physicality of Tai Chi is explained in Verhagen, Immink, van der Meulen, and Bierma-Zeinstra (2004) article:

TCC exercise emphasizes continuous slow (flowing) movements, with small to large expressions of motion, unilateral to bilateral shifts of body weight, and rotation of the trunk, head and extremities, combined with a deep diaphragmatic breathing and relaxation. During these movements, TCC practitioners have to control their centre of gravity and remain very stable. (p. 108)

The series of postures, performed slowly and in a sequence, are known as forms. The forms vary in the number of postures, with some involving as few as 18 postures and others more than 100 (Field, 2011). There are many different styles of Tai Chi, and each one has its own form (Kuramoto, 2006). The style of Tai Chi that is most often used in research studies is the modified Yang style, which in this context typically has 10 to 24 forms (Verhagen et al., 2004).

Qigong is the foundation of Tai Chi practices, and is “the broader term for developing and balancing the body’s energy through breathwork, meditation, and particular movements, which are often incorporated into Tai Chi exercises” (Horowitz, 2011, p. 263). The word Qigong is made up of two Chinese words. Qi is usually translated to mean the life force or energy that flows through all things in the universe. Gong is usually translated to mean accomplishment or skill that is cultivated through steady work or practice. Together, Qigong means cultivating energy or exercising your internal energy (National Qigong Association, n.d). Tai Chi has become one of the best known and most highly choreographed forms of Qigong (Rogers, Larkey, & Keller, 2009). To follow is a review of scholarly research on Tai Chi, health, and healthy older adults.

### 2.4.3 Tai Chi, health, and healthy older adults

There is a substantial and growing body of research on Tai Chi in relation to health and wellbeing (Guoyan, Liqiong, Jun, Yan, & Jianping, 2014). The numerous systematic reviews on Tai Chi and health which have already been conducted will shape the following section.

Most of the research on Tai Chi at large is focused on balance, particularly in older adults (Field, 2011). When considering systematic reviews focused on Tai Chi and health in healthy older adults specifically, balance and falling remained a primary focus. Many reviews concluded that Tai Chi is a means to, or potentially a means to, improve balance (Chiang, Cebula, & Lankford, 2009; Hackney & Wolf, 2013; Huang & Liu, 2015; Komagata & Newton, 2003; Liu & Frank, 2010; Maciaszek & Osinski, 2010; Schleicher, Wedam, & Wu, 2012; Wu, MacDonald, & Pescatello, 2016); reduce falls (Chiang et al., 2009; Gregory & Watson, 2009; Low, Ang, Goh, & Chew, 2009; Schleicher, Wedam, & Wu, 2012); reduce the risk of falls (Hu et al., 2016; Huang, Feng, Li, & Lv, 2017; Low et al., 2009; Rogers et al., 2009); and reduce fear of falls (Harling, 2008; Schleicher, 2012). Other variables which are less researched but have proven, at least in some cases, to be positively affected by Tai Chi include cardio-respiratory function (Chiang, et al. 2009; Rogers et al., 2009; Zheng et al., 2015); cognitive function (Miller & Taylor-Piliae, 2014; Wayne et al., 2014); physical function, depression, and anxiety (Rogers et al., 2009); muscle strength and shoulder and knee flexibility (Chiang et al., 2009); and overall health and wellbeing (Wang Collet, & Lau, 2004).

The main limitation of Tai Chi literature is the need for better methodology and study design. The most frequently criticized variables under this umbrella, which often make it difficult or impossible for researchers to systematically compare studies on Tai Chi, health, and older adults are: small sample size (Harling, 2008; Huang & Liu, 2015; Lee, Lee, Kim, & Ernst, 2010; Rogers et al., 2009; Maciaszek &

Osinski, 2010; Wayne et al., 2014); lack of randomisation and control groups to account for confounding variables (primarily gender) (Gregory & Watson, 2009; Komagata & Newton, 2003; Maciaszek & Osinski, 2010; Rogers et al., 2009; Wu, 2002; Zheng et al., 2015); wide variation of Tai Chi styles (Lee et al., 2010; Liu & Frank, 2010; Low et al., 2009; Wu, 2002); lack of long term follow ups (Harling, 2008; Liu & Frank, 2010; Verhagen et al., 2004; Wayne et al., 2014; Zheng et al., 2015); means of measuring variables too varied (Harling, 2008; Huang & Liu, 2015; Rogers et al., 2009, Wu, 2002); duration of intervention period too varied (Huang & Liu, 2015; Rogers et al., 2009; Wu, 2002); and a lack of blinding (Lee et al., 2010; Verhagen et al., 2004; Zheng et al., 2015). Other limitations include widely varied qualification of Tai Chi instructors (Komagata & Newton, 2003; Lee, 2010; Liu & Frank, 2010) and a lack of stratification regarding age (old-old, middle-old, young-old) and frailty (frail, pre-frail, different extents of fear of falling) which if addressed could help clarify treatment effectiveness (Harling & Simpson, 2008; Liu & Frank, 2010; Maciaszek & Osinski, 2010). There is a clear need for a larger number of well-designed and rigorous randomized controlled trials.

Another limitation is publication and language bias. Though Tai Chi is an ancient practice, its research in western countries is relatively recent, and it is often considered a form of complementary medicine. Therefore, it is likely that research concerning the health benefits of Tai Chi will be published in Chinese and/or in journals not included in regular databases (Verhagen et al., 2004).

Much of the research conducted in Asia is not widely not accessible, has not been translated, and/or does not follow rigorous scientific methods:

Unfortunately, many studies of Tai Chi lack rigorous scientific methods, and most investigations have been retrospective and have not used randomized control groups. It should also be noted that none of the studies from Asia were RCTs. In contrast to those published in the United States and other Western countries, almost all the studies published in mainland China, Hong Kong, and Taiwan reported positive results. Studies may have been conducted with different levels of methodologic rigor, and publication bias may be greater in some countries than in others. (Wang et al., 2004, p. 500)

The large variation in Tai Chi styles across research is also problematic. Pairing the Tai Chi style and the variables being measured can heavily influence results, which adds an immense level of complexity and is often not given proper consideration. For example, in studies concerning falls or balance, Yang style is most often chosen for the intervention (Wu, 2002). However, Wu style (which has a less stable stance) may be better for improving balance, while Yang style may be a better exercise for strengthening the lower body (Wu, 2002). The variation in styles also makes it difficult to compare research results.

Though more definitive conclusions may be drawn after further rigorous research is conducted, the present study aligns itself with the current literature on Tai Chi and rests on the assumption that it positively affects health in healthy older adults. The literature on Tai Chi guided methodological considerations around means of measuring health in the clinical study. Because most of the literature is focused on balance, this research included two means of measuring balance. In addition, heart rate and blood pressure were measured, as there is also substantial literature on Tai Chi's beneficial effects on cardiovascular function (Chiang et al., 2009; Rogers et al., 2009; Zheng et al., 2015). By including these measures, we can determine if the results of the present study are consistent with Tai Chi literature, thus determining whether our means of measuring were sensitive to the expected effects.

#### 2.4.4 Summary

There is substantial evidence of Tai Chi's potential to improve health in healthy older adults, specifically around balance and falls. That being said, the lack of well designed, methodologically sound trials coupled with the wide variation in Tai Chi styles has resulted in inconsistent outcomes and many unanswered questions. The present study rests on the assumption that Tai Chi positively

affects health in healthy older adults. This assumption, and the literature supporting it, helped determine the choice of Tai Chi as a control group for this research, along with measuring balance and cardiovascular function, as further discussed in Chapter 3.

## 2.5 Summary

This chapter covered three main areas of literature in relation to physical, cognitive, and emotional health in healthy older adults: ageing, poi, and Tai Chi. We are currently experiencing unprecedented population ageing worldwide, with chronic disease becoming the leading cause of disability and death. There is a substantial amount of scholarly research on ageing and physical, cognitive, and emotional health in healthy older adults. This research concludes that addressing health and wellbeing in older adults is of utmost concern, and simple, effective, and affordable strategies for maintaining health in old age are urgently needed. There is a paucity of rigorous research on Māori and International Poi in general, and only one study on poi and health (specifically self-regulation). Literature on play, meditative movement, and flow state were also discussed in relation to International Poi, in order to provide further background knowledge and insights. Before any conclusions can be made about poi and health, a significant amount of scholarly research is needed. There is a substantial amount of research on Tai Chi in relation to physical, cognitive, and emotional health in healthy older adults, with an increase in the quantity of studies and evidence supporting Tai Chi's benefits over the past 50 years. The majority of the literature concludes that Tai Chi has, or has the potential to, positively affect health, with a focus on balance and falling. Though there is evidence for Tai Chi's potential to improve health, Tai Chi research in western countries is relatively recent, and much of the research conducted in Asia is either not accessible, has not been translated, or does not follow rigorous scientific methods. This combined with a wide variation in Tai Chi styles, and a lack of

well designed, methodologically sound trials, has resulted in inconsistent outcomes. The literature on ageing, poi, Tai Chi, and health has guided the methodological considerations of this thesis, which are described in the following chapter.

# 3. Methodology

## 3.1 Chapter overview

The following chapter will describe both the methodology, or “philosophical approaches to discovering knowledge” (Killam, 2013, p. 9), and the methods or specific processes and techniques for collecting and analyzing data utilized in this study. This chapter begins with a discussion of the philosophical assumptions and theories upon which the methodology is based, then provides a detailed description of the methods, protocols, and process of analysis for both the clinical study and follow-up questionnaires. The overarching purpose of this chapter is to provide transparency so that readers can evaluate the soundness of the philosophical assumptions, study protocols, and data collection and analysis methods. Transparency will also enable replication of this study, which is vitally important for determining whether its results are valid and reliable (Barrow, 1991; Creswell, 2003; Kuhn, 1962; Wilson, 1952).

## 3.2 Philosophy and methodology

Philosophy is the study of general and fundamental problems concerning the nature of existence, knowledge, values, reason, and human purpose (Honderich, 1995; Paul, 1967; Teichmann & Evans, 1999). Philosophy is particularly important to methodology because decisions on what phenomena to study and how to study them are guided by philosophical assumptions and/or theories. Though these decisions are often sub-conscious, this section aims to make them transparent.

While there are a number of branches of philosophy and several ways to categorize them, the fields of axiology which is the study of value, ontology which is the nature of reality, and epistemology which is the nature of knowledge, are especially relevant to methodology (Killam, 2013). A discussion of each of these fields and their relationship to the methodology of this thesis follows.

### 3.2.1 Axiology and methodology

Axiology is the branch of philosophy dealing with values, such as judgments of good and bad, or right and wrong (Findlay, 1970; Hartman, 1967; Rescher, 2005). This study is based on a few value assumptions that are particularly relevant to methodology. One assumption is that physical (Warburton, Nicol, & Bredin, 2006) and cognitive (Gates & Valenzuela, 2010) exercise/training are both beneficial for older adults health and wellbeing. This assumption guided the choice to study the effects of International Poi on ageing. Another assumption is that pure research or generating new knowledge for its own sake, and applied research or generating new knowledge to address specific problems (which can at the most basic level be considered the two types of science), are both desirable and appropriate uses/purposes of research (Shuttleworth, 2008).

These assumptions, coupled with the following research aims, lay the foundation for subsequent methodological decisions. First, as discussed in Chapter 2, there is a paucity of research on poi and health, and even less on International Poi specifically. This thesis seeks to at least partially fill that void. Second, this thesis aims to provide data regarding the efficacy of International Poi for improving health in older adults. The number of adults over 60 years old is growing at an unprecedented rate, and there is a great deal of public interest regarding this development (United Nations, 2009). Policy and practice decisions regarding how to address this phenomenon should be as informed as possible, and data regarding International Poi and health may be of interest as the young-old balance shifts

throughout the world. The implications of the data generated by this research for future research, policy, and practice are discussed in the concluding chapter of this thesis.

### 3.2.2 Ontology and methodology

Ontology is the branch of philosophy dealing with the nature of being and the nature of reality, or judgments of what is real or what exists (Burkhardt & Smith, 1991; Grossmann, 1992; Johansson, 1989; Killam, 2013). Because the nature of reality is crucial to the perspective and design of research, ontology is at the heart of methodological decisions. There are two overarching ontological approaches to methodology, which can take on various labels such as objectivism and subjectivism, positivism and phenomenology, or positivism and interpretive alternative or more simply interpretivism (Holden & Lynch, 2004). Although there is no universally agreed upon taxonomy of these terms, interpretivism is often used as a broad term that includes social constructivism, phenomenology and hermeneutics, and therefore this thesis will include both positivism and interpretivism (Collins, 2010, p. 38).

In general, interpretivism maintains that reality is subjective. This means that human beings construct reality and construct meaning based on their experiences (Krauss, 2005). Interpretivist research typically investigates a small sample over time, and relies on qualitative methods such as non-standardized interviews and observations (Holden & Lynch, 2004). The goal of interpretivism is to understand and explain what is happening, the quality of experience, motivations, feelings and meanings, and involvement of the researcher is actively encouraged (Holden & Lynch, 2004).

In general, positivism maintains that reality is objective. This means that there is one reality, and it does not change because it is being observed (Krauss, 2005). Positivist research is predominant in natural science, and relies on the scientific method/quantitative methods such as experiments and statistical analyses. The goal of positivism is to simply observe, measure and describe what we experience. The data and its analysis strive to be value-free, and thus the researcher is distanced from her/his subjects so as to avoid bias as much as possible.

This thesis primarily takes a positivist methodological approach via a clinical study, in order to best fulfil the research aims of filling a void in poi, health and ageing research, and providing data for researchers, policy makers, and practitioners. Because positivism has been the ontology of most research and practice for the past century, and because most policy makers are positivists (Morçöl, 2001), emphasizing this approach will, hopefully, maximize the impact of this thesis.

In addition to the clinical study, an interpretivist method (follow-up questionnaires) was employed to augment the data generated by the clinical study, in the hopes of generating greater understanding of the data and therefore providing the researcher with greater explanatory power. This thesis follows the philosophy that methodology should be chosen based on what one is trying to do rather than a commitment to a particular paradigm, and different modes of research allow us to understand different phenomena for different reasons (Krauss, 2005).

### 3.2.3 Epistemology and methodology

Epistemology is the branch of philosophy dealing with the nature of knowledge (for example judgments of truth and rationality, how we come to know what we know), and the relationship between knowledge and the researcher during discovery (Alston, 1989; Chisholm, 1989; Dancy, Sosa,

& Steup, 1993; Killam, 2013,). Knowledge can be acquired in two ways: from the mind or a priori, meaning knowledge is independent of experience and requires only the use of reason, and, secondly, from sensory experience or a posteriori, meaning knowledge is dependent on experience, and requires data from our senses (Müller-Merbach, 2007). There are a number of main theories of knowledge acquisition, primarily that of empiricism, rationalism, constructivism, and idealism (Mastin, 2008).

As with ontology, the epistemology of this thesis was influenced by the prior axiological decision to use this thesis to provide data for researchers, policy makers, and practitioners. Because empiricism has been the dominant scientific paradigm for the past century (McLeod, 2008) and because most studies concerned with policy are empirical (Gehring & Galston, 2003), it was decided that the methodology of this study should rely primarily on empiricism via a clinical study. Empiricism in the philosophy of science emphasizes evidence, especially as discovered in experiments (Alston, 1989; Sober, 1993; van Fraassen, 2002). Hypotheses and theories must be tested against observations of the world rather than resting solely on logic, intuition, or revelation. The emphasis on empiricism in this thesis will hopefully maximize the chances of its acceptance amongst its intended audience.

In addition to the clinical study, follow-up questionnaires were utilized which were based on a constructivist epistemology. This epistemology asserts that researcher and research are “interactively linked so that the ‘findings’ are literally created as the investigation proceeds” (Guba & Lincoln, 1994, p. 111). Moreover, a constructivist epistemology acknowledges that researchers possess unique experiences and perspectives which influence their research and in fact strengthen it. Thus, this researcher’s past experiences with and current perspectives toward poi are inextricably intertwined

with her interpretations of the data generated by questionnaires and indeed lend additional credence to them (Eisner, 1998).

The remainder of this chapter details the methodological considerations and protocols behind the clinical study and the follow-up questionnaires.

## 3.3 Clinical study

### 3.3.1 Introduction

The following section will detail the methodological considerations and protocols of the clinical study. The aim of this section is to provide transparency so that readers can evaluate the soundness of the methodological considerations and protocols, and to provide sufficient detail for replication of this study.

### 3.3.2 Methodological considerations

#### 3.3.2.1 Determining the poi style

While conducting a study involving Māori Poi is recommended for future research, International Poi was a better fit for the parameters of the present study for the following reasons:

1. As this was the first scientific study on poi, health, and older adults, it was important to isolate the fundamental act of spinning a weight on the end of a flexible cord, in order to see if this act alone had an effect on health. Practicing Māori Poi in isolation separates the poi from its cultural context, which violates the fundamental concepts and principles of Māori Poi. In

International Poi style, practicing in isolation does not violate any fundamental principles of the style.

2. The time available for this study was not sufficient for the trial participants to understand and master all of the cultural elements necessary to practice Māori Poi.
3. The expertise of the principal investigator and poi teacher lies in International Poi.

### 3.3.2.2 Determining the control group activity

A control group in an experiment or clinical study is a group of participants that resembles the treatment group as closely as possible, but does not receive the same treatment (Pithon, 2013).

Because the treatment is the factor being studied, the control group serves as a comparison group when results are being analyzed. Control groups are an extremely important part of scientific research, and influence virtually all aspects of a clinical study:

The choice of control group is always a critical decision in designing a clinical study. That choice affects the inferences that can be drawn from the trial, the ethical acceptability of the trial, the degree to which bias in conducting and analyzing the study can be minimized, the types of subjects that can be recruited and the pace of recruitment, the kind of endpoints that can be studied, the public and scientific credibility of the results, the acceptability of the results by regulatory authorities, and many other features of the study, its conduct, and its interpretation. (ICH Topic E 10, 2001, p. 5)

It would be best to compare a poi treatment group to a control group which is participating in an activity closely related to poi that has a substantial amount of scientific research demonstrating its efficacy. Comparing the treatment group to an active, or positive control group (as opposed to a negative control group which, in this case, would not participate in any activity or would participate passively, e.g. reading information about how to practice poi) is a good tactic when researching a new therapy or intervention. This is because active control trials can show efficacy of the new treatment by demonstrating it is as good as a known effective treatment (ICH Topic E 10, 2001). This method

also poses fewer ethical issues, as all the study participants are receiving some form of active treatment (ICH Topic E 10, 2001).

With the aforementioned information in mind, the control group activity was determined through a three step process:

1. Determine the fundamental and essential characteristics of International Poi;
2. Use these characteristics to find other activities that most closely resemble International Poi;  
and,
3. Of the activities that most closely resemble International Poi, determine which one is the most feasible in the context of the present study.

#### **3.3.2.2.1 Determining the fundamental and essential characteristics of International Poi**

In order to determine the fundamental and essential characteristics of International Poi, the principal investigator systematically observed practitioners of International Poi, reviewed the literature on International Poi, and recorded the characteristics that were absolutely necessary in order to practice International Poi (absolutely necessary meaning if the characteristic were absent, then the activity would not be referred to as International Poi). Seven characteristics were identified: object manipulation, play, ambidexterity, meditative movement, rhythm, full body aerobic exercise, cultural ties or origins. For the purposes of this thesis, these characteristics will be defined as follows.

- Object manipulation: Form of dexterity play or performance in which one or more people physically interact with one or more objects, the object(s) being integral to the play/performance, and mobile/not connected to the performer (Magill & Anderson, 2013).
- Play: Done for its own sake, with a focus on the experience, not accomplishing a goal (Brown, 2009).

- **Ambidexterity:** Activity requires equal adeptness of both left and right appendages (Miletić, Božanić, & Musa, 2009).
- **Meditative movement:** Blending physical movement and focused mental awareness with the goal of reaching flow state, in which one is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity being performed (Csikszentmihalyi, 1996; Larkey, Jahnke, Etnier, & Gonzalez, 2009).
- **Rhythm:** The regular recurrence or pattern of a movement in time (Rhythm, n.d.). The movement must depend on rhythm to be executed successfully and the rhythm must be innate in the movement (Huata, 2000).
- **Full body aerobic physical activity:** Activity in which the body's large muscles move in a rhythmic manner for a sustained period of time, such as walking, swimming, and bicycling (World Health Organization, 2010).
- **Cultural ties or origins:** The activity was born from, and plays an important historical, spiritual, and/or community role in a specific indigenous culture.

#### **3.3.2.2.2 Activities most closely related to International Poi**

After determining the fundamental and essential characteristics of International Poi, the following criteria were used to determine which control group activities to investigate. The first four criteria were selected for their ability to limit potential control groups to those that are most similar to the treatment group, as the purpose of a control group is to resemble the treatment group as closely as possible in order to isolate the variables being studied. The fifth criterion was included so that the research findings of this study could be compared to previous research findings and judgements of reliability could be made.

1. The activity has a cognitive dimension. It requires a higher level of thinking than autonomous exercises such as walking, and remains cognitively challenging for the duration of the activity.
2. The activity has a physical dimension. It requires gross motor skills.
3. The activity shares some of poi's defining characteristics.
4. The activity is appropriate for healthy older adults.
5. There have been at least two scientific studies conducted on the activity and its effect on health in healthy older adults.

Based on these criteria, the following activities were chosen to further investigate:

- Ballroom Dancing: Dance, in general, involves moving the body according to certain relationships between time and space. Ballroom dancing is a partner dance which draws upon these principles (da Silva Borges et al., 2014).
- Drum Circles: A group of people who create a rhythm together by playing drums or smaller percussion instruments. The group is usually facilitated by one or two people (Snow, 2010).
- Juggling: Manipulation of objects simultaneously; specifically keeping one object in the air while handling other objects (Magnusson & Tieman, 1989).
- Tai Chi: A form of exercise and meditation involving a series of continuous, slow, flowing movements, accompanied by deep breathing (Verhagen et al., 2004).
- Water Aerobics: A variety of movements, typically done standing vertically in waist or chest deep water, in which the water creates movement resistance (Green, 1989).
- **Wii** (Wii Fit & exercise games): Active gaming or 'exergaming', which utilizes game controllers or the wii balance board, and features activities such yoga, strength training, aerobics, and balance games (Franco, Jacobs, Inzerillo, & Kluzik, 2012).

- **Yoga:** a mind-body exercise that involves muscular activity, mindfulness, focus, and an awareness of breathing and of the self (Woodyard, 2011).

Other activities were considered but not used, such as swimming and walking (due to a lack of cognitive dimension and object manipulation) and capoeira and rhythmic gymnastics (due to a high difficulty level for older adults).

### 3.3.2.2.3 Comparing related activities to International Poi

Each activity was then compared to International Poi’s fundamental and essential characteristics, keeping in mind that in order to score a “yes” the characteristic must be absolutely necessary to the activity.

COMPARING RELATED ACTIVITIES TO INTERNATIONAL POI								
	Object Manipulation	Play	Ambi-dexterity	Meditative Movement	Rhythmic	Full body Aerobic	Cultural Ties	# of Shared Characteristics
<b>International Poi</b>	yes	yes	yes	yes	yes	yes	yes	
<b>Juggling</b>	yes	yes	yes	no	yes	no	no	4
<b>Drum Circles</b>	no	yes	yes	yes	yes	no	no	4
<b>Tai Chi</b>	no	no	yes	yes	no	yes	yes	4
<b>Ballroom Dancing</b>	no	yes	no	no	yes	yes	no	3
<b>Wii</b>	yes	yes	no	no	no	yes	no	3
<b>Yoga</b>	no	no	no	yes	no	yes	yes	3
<b>Water Aerobics</b>	no	no	yes	no	no	yes	no	2

Table 2. Comparing related activities to International Poi

### 3.3.2.2.4 Feasibility of related activities for the clinical study control group

In addition to the shared characteristics discussed above, three additional characteristics were considered relating to feasibility, both within the parameters of the present study, and looking toward

the potential for participants to continue the activity outside of the study. Cost effective activities which can be naturally incorporated throughout the day are likely to be the most successful for older adults (King, Rejeski, & Buchner, 1998).

FEASIBILITY OF RELATED ACTIVITIES FOR THE CLINICAL TRIAL CONTROL GROUP				
	Cost less than \$20 for materials per person	Can be done individually, within a group	Can be done anywhere	# of feasibility characteristics
<b>International Poi</b>	yes	yes	yes	
<b>Tai Chi</b>	yes	yes	yes	3
<b>Yoga</b>	yes	yes	yes	3
<b>Juggling</b>	yes	yes	yes	3
<b>Drum Circles</b>	no	yes	yes	2
<b>Water Aerobics</b>	yes	yes	no	2
<b>Ballroom Dancing</b>	yes	no	yes	2
<b>Wii</b>	no	no	no	0

*Table 3. Feasibility of related activities for the clinical study control group*

By adding the scores of the two tables above, the activities' overall scores were -

juggling: 7 , Tai Chi: 7, drum circles: 6, yoga: 6, ballroom dancing: 5, water aerobics: 4, Wii: 3.

Ultimately, Tai Chi was chosen as the control group activity because there is significantly more research on Tai Chi and healthy older adults.

### 3.3.2.3 Determining the pre- and post-test measurements

A list of potential variables to be measured in the pre- and post-tests was composed based on two overarching criteria: the variable's relevance to ageing and International Poi, and the means of measuring the variable. A variable's relevance to ageing was determined primarily by how frequently the term appeared in a title search on Google Scholar (see the second column below), and secondarily by how prominent that variable was in the studies in which it appeared. A variable's relevance to

International Poi was determined by how important the variable was to each of International Poi's essential characteristics as defined above. Variables that had primarily invasive means of measuring, or were too physically demanding for older adults, were not considered.

### 3.3.2.3.1 Choosing variables

VARIABLE'S RELEVANCE TO AGEING AND INTERNATIONAL POI					
Variable	"Search Term" AND ageing OR elderly OR older (in the title)	Results	Most Common Non-Invasive Means of Measuring	Relevance to ageing	Relevance to Poi
Balance	"postural balance" "postural control" balance	87 230 2,200	Romberg Test, Functional Reach Test, Berg Balance Scale, Timed Get Up And Go, BESS	3	2
Bimanual Coordination	"bimanual coordination" "eye-hand coordination"	16 14	rhythmic finger-tapping task, circle tracing, other variations of in-phase and anti-phase movements	2	3
Blood Pressure	"blood pressure"	2,100	sphygmomanometer	3	1
Cognitive Flexibility	"cognitive flexibility"	17	categorisation tasks, alternative-uses test, Shifting Attention Test, Stroop	2	2
Complex Attention/ Multi-Tasking	"complex attention" multitasking	4 8	SIMKAP simultaneous capacity, The Multi-Attribute Task Battery	2	2
Flow State	"trance state" "flow state"	0 1	Flow State Scale, interviews	1	3
Heart Rate	"heart rate"	488	electrocardiogram, manually take pulse	2	1
Manual Dexterity	"manual dexterity" dexterity	12 24	9 hole pegboard, Grooved Peg Board, less common tests include Minnesota Manual Dexterity Test, pick up tests, O'Connor Finger Dexterity Test, Box and Block Test	2	2
Motor Learning	"motor learning"	75	charting the number and type of correct decisions or errors made by the learner	2	2
Playfulness	playfulness	4	surveys, e.g. Adult Playfulness Scale, Older Adult Playfulness Scale, Test of Playfulness	1	3
Psychomotor Speed	"Psychomotor speed"	9	Finger Tapping Test, Symbol Digit Coding Test	2	2

Psychological Well-Being	“psychological wellbeing” “wellbeing” “quality of life”	312 576 1,750	salivatory cortisol test, surveys e.g. Life Satisfaction Index, Positive and Negative Affect Scales New General Self-Efficacy Scale.	3	3
Range of Motion: upper limb (wrist, forearm, elbow, shoulder)	“wrist flexibility” “wrist extension” “range of motion” wrist “elbow flexibility” “range of motion” elbow “shoulder flexibility” “range of motion” shoulder range of motion “upper limb”	0 0 2 0 2 0 6 1	goniometer	2	3
Reaction Time	“reaction time”	3	Stroop (simple or complex reaction time tests)	2	3
Strength: grip	“hand strength” “grip strength”	17 128	hand grip dynamometer, Pinch Gauge	3	2
Strength: upper limb (wrist, arm, shoulder)	“wrist strength” “forearm strength” “tricep strength” “bicep strength” “arm strength” “shoulder strength” “upper limb” strength	0 0 0 0 1 3 6	force gauge, dynamometer, Manual muscle testing	2	2
Strength: lower body	“lower body strength”	8	force gauge dynamometer, chair stand / 30 Second Chair Stand Test, other timed task tests possible	2	2
Working/ Composite Memory	“working memory” “composite memory”	156 1	Working Memory Capacity tests such as reading span, numerical updating, spatial coordination, binding tasks	3	1

*Table 4. Variable’s relevance to ageing and International Poi*

Of the most common means of measuring each variable, the best mean(s) were chosen based on the time necessary to execute the test (with the goal of having each test session take no longer than an hour and a half), the cost of any supplies necessary to execute the test, and how well the test might relate to the act of spinning International Poi (for instance, the Functional Reach Test under the Balance variable engages the upper limb, potentially making it a better choice than balance tests which do not engage the upper limb, as International Poi requires extensive upper limb use).

Five cognitive variables (complex attention, cognitive flexibility, psychomotor speed, reaction time, and working/composite memory) were specifically included above, as the average of their domain scores make up the Neurocognition Index, a global score of neurocognition (“CNS Vital Signs”, 2015).

### 3.3.2.3.2 Choosing best means of measuring

The best means of measuring each variable was determined as follows.

COMPARISON OF MEANS TO MEASURE VARIABLES			
Variable	Most Common Non-Invasive Means of Measuring	Time to execute test	Cost of test
Balance	Romberg Test	>1 minute for 1 trial	\$0
	Functional Reach Test	>1 minute for 1 trial	\$0
	Berg Balance Scale	15 min for full, could do part	\$0
	Timed Get Up And Go (TUG)	>1 minute for 1 trial	\$0
	BESS	>5 minutes for 1 trial	\$10 for mat
Bimanual Coordination	rhythmic finger-tapping task	>5 minutes	\$15 per test
	circle tracing	>5 min for 1 trial (anti and inphase)	\$0 (unless done digitally)
Blood Pressure	sphygmomanometer	>1 minute for 1 trial	\$20
Cognitive Flexibility	Shifting Attention Test	5 minutes	\$15 per test
	Stroop	8 minutes	\$15 per test
Complex Attention/Multi-Tasking	SIMKAP simultaneous capacity	15 - 40 minutes	\$400
	CNS battery (Stroop Test, Shifting Attention Test, and Continuous Performance Test)	15 minutes	\$15 per test
Flow State	Flow State Scale	5 min short version, 10 for long	\$0
	interviews	10 - 15 minutes	\$0
Heart Rate	electrocardiogram	too complicated to execute	\$200
	manually take pulse	>1 minute for 1 trial	\$0
Manual Dexterity	9 hole pegboard	>5 min for 1 trial (right, left, both)	\$50
	Grooved Peg Board (other tests include Minnesota Manual Dexterity Test, pick up tests, O’Connor Finger Dexterity Test, Box and Block Test)	>5 min for 1 trial (right, left, both)	\$100
Motor Learning	chart the number and type of correct decisions or errors made by the learner	5 - 20 minutes	\$0
Playfulness	surveys, e.g. Adult Playfulness Scale, Older Adult Playfulness Scale, Test of Playfulness	5 - 20 minutes	\$0

Psychomotor Speed	Finger Tapping Test	4 minutes	\$15 per test
	Symbol Digit Coding Test	2 minutes	\$15 per test
Psychological Well-Being	surveys (e.g. Life Satisfaction Index, Positive and Negative Affect Scales, New General Self-Efficacy Scale)	5 - 20 minutes	\$0
	Salivary cortisol test	>1 minute	\$50-150 lab fee
Range of Motion: upper limb	goniometer	>15 minutes for all upper limb	\$10
Reaction Time	Stroop (simple or complex reaction time tests)	5 minutes	\$15 per test
Strength: grip	hand grip dynamometer	>1 minute for 1 trial	\$5 - \$200
	pinch gauge	>1 minute for 1 trial	\$180
Strength: upper limb	force gauge dynamometer	>15 minutes for all upper limb	\$300
	manual muscle testing	>15 minutes for all upper limb	0
	arm curl	>1 minute for each arm	0
Strength: lower body	force gauge dynamometer	>15 minutes for all lower body	\$300
	30 Second Chair Stand Test (other timed task tests possible)	>1 minute for 1 trial	0
Working/ Composite Memory	CNS Verbal Memory Test	5 minutes	\$15 per test
	CNS Visual Memory Test	5 minutes	\$15 per test

*Table 5. Comparison of means to measure variables*

The means of measuring the cognitive variables was ultimately determined by the options available in CNS Vital Signs, the cognitive test battery used in the present study (“CNS Vital Signs”, 2015). CNS Vital Signs was chosen as it was used successfully in a previous study at the University of Auckland, and some remaining test sessions from that study could be utilized for free in the present study.

Based on the information above, a preliminary list of variables and means of measuring was determined:

- Balance (Functional reach, Timed Get Up And Go)
- Bimanual coordination (circle tracing)
- Blood pressure (sphygmomanometer)
- Cognitive flexibility (CNS Shifting Attention Test, Stoop Test)
- Complex attention (CNS Shifting Attention Test, Stroop Test)
- Composite memory (CNS Verbal Memory Test, Visual Memory Test)
- Grip strength, pinch and hand (hand grip dynamometer, pinch gauge)
- Heart Rate (manually take pulse)
- Lower body strength (30-Second Chair Stand Test)
- Manual Dexterity (9 Hole Peg)

- Motor speed (CNS Finger Tapping Test)
- Processing speed (Symbol Digit Coding Test)
- Psychomotor speed (CNS Finger Tapping Test, Symbol Digit Coding Test)
- Psychological wellbeing (36-Item Short Form Survey)
- Range of motion, wrist, elbow, and shoulder (goniometer)
- Reaction time (CNS Stroop Test)

Four variables from the initial list were eliminated in the final list. Flow State and Play were eliminated as they were the least relevant to an ageing population in comparison to the other variables being considered. Upper Limb Strength was eliminated because in order to measure accurately, expensive and complicated equipment is necessary. Motor learning was eliminated because it was activity specific (e.g., golf motor skills). It should also be noted that the list above shifted slightly in round 2 of the study, with the addition of the 4 Stage Balance Test and CNS Continuous Performance Test. The final list of variables is as follows. Measures only used in round 1 are crossed off, and measures only used in round 2 are in italics.

- Balance (Functional reach, ~~Timed Get Up And Go~~, *4 Stage Balance Test*)
- Bimanual coordination (circle tracing)
- Blood pressure (sphygmomanometer)
- Cognitive flexibility (CNS Shifting Attention Test, Stoop Test)
- *Simple attention (CNS Continuous Performance Test)*
- Complex attention (CNS Shifting Attention Test, Stroop Test)
- Composite memory (CNS Verbal Memory Test, Visual Memory Test)
- Grip strength, pinch and hand (hand grip dynamometer, pinch gauge)
- Heart Rate (manually take pulse)
- Lower body strength (30-Second Chair Stand Test)
- Manual Dexterity (9 Hole Peg)
- Motor speed (CNS Finger Tapping Test)
- Processing speed (Symbol Digit Coding Test)
- Psychomotor speed (CNS Finger Tapping Test, Symbol Digit Coding Test)
- Psychological wellbeing (36-Item Short Form Survey)
- Range of motion, wrist, elbow, and shoulder (goniometer)
- Reaction time (CNS Stroop Test)

Even though the tests used only in round 2 were not part of the initial methodological considerations, they will be described in the measures section below to provide information about their reliability.

The reasoning behind the addition of these tests is discussed in Chapter 5.

### 3.3.3 Protocol

In order to study the effects of International Poi on physical, cognitive, and emotional health in healthy older adults, an assessor-blind randomized controlled study was conducted. Randomized controlled trials (RCT) are the gold standard of research design (Cartwright, 2010; Chalmers et al., 1981; West et al., 2008). West et al. (2008) note that:

[An RCT] has the highest internal validity because it requires the fewest assumptions to attain unbiased estimates of treatment effects. Given identical sample sizes, the RCT also typically surpasses all other designs in terms of its statistical power to detect the predicted effect. (p. 1363)

In addition to randomization, the present study was assessor-blind, meaning that data were collected by staff who did not know participant group allocation. Blinding helps prevent bias, as participants cannot be treated differently based on their group (Karanicolas, Farrokhyar, & Bhandari, 2010).

Therefore, an assessor-blind randomized controlled study is an optimal framework for comparing the effects of International Poi and Tai Chi on health in older adults. The following section will detail the clinical study methods and protocol, specifically the ethics, participants, group allocation, timeline, measures, and lessons.

#### 3.3.3.1 Ethics

Ethical approval was gained from the University of Auckland Human Participants Ethics Committee on November 25, 2015, for a period of three years (reference number 014986). The main ethical issues of the clinical study relate to voluntary participation, the right to withdraw, anonymity of data, and minimization of risks. The Participant Information Sheet made it clear to potential participants that taking part was entirely voluntary, and they were free to withdraw at any time without giving a reason (see Appendix B). All data was anonymized and securely stored (for six years) prior to secure

destruction. No information that could be linked to an individual was or will be published. The risks of participation were minimal, and minimized by screening potential participants for balance and musculoskeletal problems, having first aid certified staff (the researcher) present for every test session and treatment session, and ensuring the space used for training was appropriate.

### 3.3.3.2 Participants

Participants were recruited by mailing lists, social media, and/or flyers at the following locations/organizations: the Research Volunteer Register at the Centre for Brain Research, the examination invigilator list at the University of Auckland, Selwyn Village, Edmund Hillary Retirement Village, Alliance Francaise, Circability, local Rotary Clubs, libraries, community centers, Returned Services Associations, athletic organizations (e.g. lawn bowling, badminton, etc.), and various social media platforms through the University of Auckland (e.g. the National Institute for Creative Arts and Industries twitter page, the Dance Studies facebook page, etc.). In addition, details on how to participate were disseminated through various media coverage, including The New Zealand Herald, TV One News, Radio New Zealand, and NewsTalk ZB.

The sample participating in this study were healthy adults age 60 or older. Before taking part in the study, potential participants used a self-screening exercise questionnaire to determine if they may have any neurological disorders, musculoskeletal disorders and/or dizziness or faintness during physical activity that may put them at risk during the study (see Appendix B). If they reported any of the aforementioned disorders, they were advised to consult with their doctor before proceeding. If they did not, the volunteer was considered “healthy.” A potential participant was considered an “older adult” if they were 60 years of age or older at the time the first pre-test began. Volunteers were also asked to report on any prior experience with International Poi or Tai Chi. No volunteers had

any prior experience with International Poi. For volunteers with prior Tai Chi experience, the following rubric was used to determine if they were eligible:

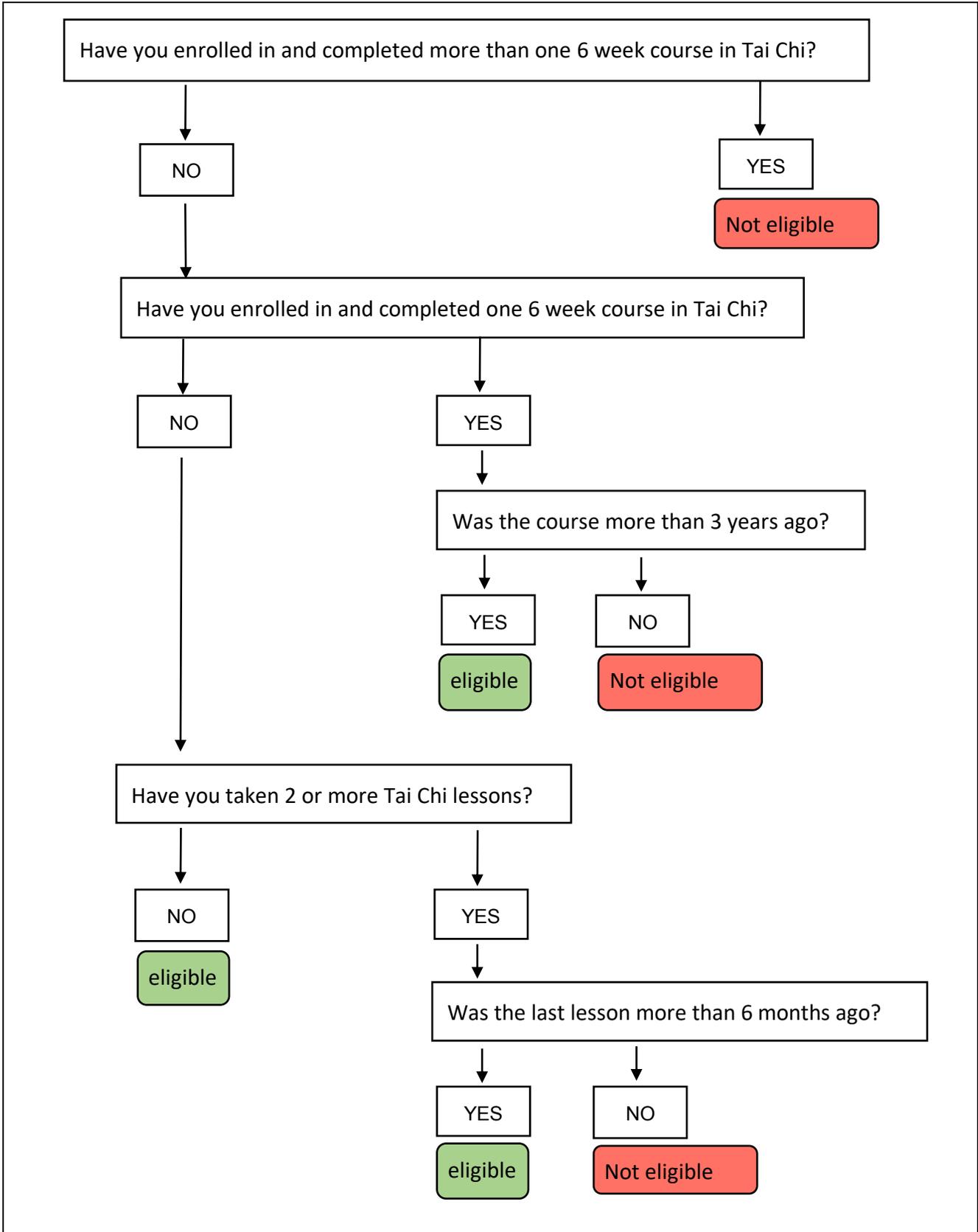


Figure 2. Flowchart of Tai Chi prior experience

There were no other exclusion criteria. Potential participants had the option to meet with the Principal Investigator in person before beginning the study, to discuss any questions or concerns. All volunteers provided written informed consent prior to participation in the study (Appendix B).

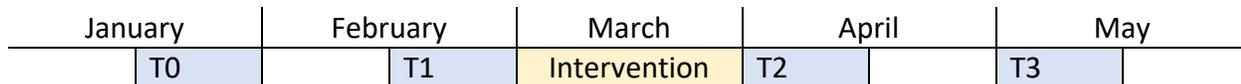
### 3.3.3.3 Group allocation

Participants were randomly allocated to either the International Poi group or Tai Chi group using free software ([www.rando.la](http://www.rando.la)) to minimize between group differences in age and gender. As previously discussed, randomization is a standard research design protocol (Cartwright, 2010; Chalmers et al., 1981; West et al., 2008).

### 3.3.3.4 Timeline

The study was conducted in two rounds between January 2016 and July 2017. The first round of the study had a one month intervention period, and the second round of the study had a two month intervention period, to address the potential criticism of the intervention being relatively short. The reason for having two test sessions before the intervention began was to detect any effects of practice (if scores improved between the first and second test session, then we know this improvement was not due to the intervention). This “dual baseline assessment” is one way to reduce the influence of practice effects, as results from the second test session are more stable and can be used for comparison with subsequent assessments (McCaffrey & Westervelt, 1995). The timelines for both rounds of the study are as follows. “T1”, “T2”, etc. represent each test session time point.

### Round 1 (2016)



### Round 2 (2017)

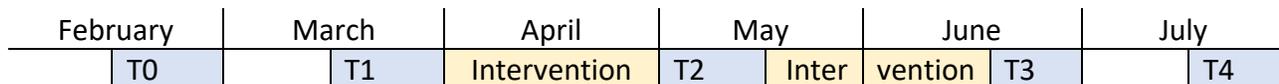


Figure 3. Intervention timeline

In round 1, an initial pre-test (T0) was conducted one month prior to the intervention. A second pre-test (T1) was conducted immediately before the intervention began. The first post-test (T2) was conducted immediately after the one month intervention period. The last post-test (T3) was conducted one month post intervention.

In round 2, an initial pre-test (T0) was conducted one month prior to the intervention. A second pre-test (T1) was conducted immediately before the intervention began. A mid-test (T2) was conducted half way through the intervention, after one month of lessons. The first post-test (T3) was conducted immediately after the two month intervention period. The last post-test (T4) was conducted one month after the intervention ended.

Though the two timelines are different, the primary focus of this study is the time points immediately prior to and immediately after the one month intervention, as data from the entire sample were available at these time points. A discussion of the impact of the extended intervention in round 2 is discussed in Chapter 5.

### 3.3.3.5 Measures

All tests were safe, non-invasive, standard means of measuring physical, cognitive, and emotional health. To follow is a description of each test and its reliability, or consistency, with healthy older adults. Three aspects of reliability are commonly of interest: test-retest reliability, interrater reliability, and intrarater reliability. These are defined as follows:

- Test–retest reliability: presenting the same task to the same subjects two or more times.
- Intrarater reliability: presenting the same task repeatedly to one rater.
- Interrater reliability: presenting the same task to two or more raters.

(Rousson, Gasser, & Seifert, 2002)

In other words, test-retest reliability reflects if a certain task is able to render reliable results, or whether the results are dependent on the situation or the subject. Intrarater reliability measures if one rater can produce consistent results while administering a task. Interrater reliability measures if multiple raters can produce consistent results while administering the same task. Both depend primarily on good staff training and good standardization of the tests (Rousson et al., 2002). A common metric for quantifying test-retest reliability, intrarater reliability, and interrater reliability is the intraclass correlation coefficient (ICC). ICC assesses reliability by comparing the variability of different ratings of the same subject, to the total variation across all subjects and ratings (Koch, 1982). ICC ranges from 0 – 1, with a high ICC indicting high similarity between values from the same group.

#### 3.3.3.5.1 Physical measures

*Balance (Functional Reach, Timed Up And Go, 4 Stage Balance Test)*

The Functional Reach Test (FRT) assesses a person's stability by measuring the maximum distance they can reach forward while standing in a fixed position. Participants were instructed to stand next to, but not touching, a wall, and raise the arm closest to the wall to 90 degrees with a closed fist. They were then instructed to reach as far as they could without taking a step, twisting, or lifting their heels. Based on a yardstick attached to the wall, assessors marked the position of the 3rd metacarpal before and after reaching. Three trials were done on each side, and the average of the last two were used for the final score (Weiner, Duncan, Chandler, & Studenski, 1992). For community dwelling older adults, the FRT has excellent test-retest reliability (ICC = 0.89) (Weiner et al., 1992), and excellent interrater/intrarater reliability (ICC = 0.92) (Duncan, Weiner, Chandler, & Studenski 1990).

For the Timed Up and Go Test (TUG), participants were instructed to sit down with their back against the back of the chair and their arms on the arm rests. They were then instructed to walk to a line on the floor (three meters away), walk around a small ball on the ground, walk back to the chair, and sit down. Participants were told to move at their normal, comfortable walking pace. Assessors timed participants, beginning when they said "go", and ending when the participant was sat back down in the chair. For community dwelling older adults, the TUG has excellent test-retest reliability (ICC = 0.97) (Steffen, Hacker, & Mollinger, 2002), and good interrater reliability (ICC = 0.99) (Podsiadlo & Richardson, 1991).

The 4 Stage Balance Test is a measure of static balance, or the ability to maintain a posture with a restricted base of support. Participants were instructed to assume four different positions of increasing difficulty: 1) feet side by side, 2) the instep of one foot touching the big toe of the other foot, 3) one foot in front of the other, heel touching toe, and 4) one foot. Participants were allowed to use the assistance of a chair or table to get into each position. Once the participant let go of the

assistive device, she/he was timed for 10 seconds. If the participant held the position for 10 seconds, she/he moved on to the next position. The 4 Stage Balance Test is a reliable and valid measure of static balance with good test-retest reliability (.66 Interclass Pearson Correlation) (Rossiter-Fornoff, Wolf, Wolfson, Buchner, & FICSIT Group, 1995).

### *Bimanual coordination*

Bimanual coordination was measured with a circle tracing task, in which participants were asked to trace circles simultaneously with both hands, while following a set of instructions as explained below. In order to determine the parameters for the circle tracing task, a literature review on bimanual coordination and circle tracing was conducted. Twenty one studies were consulted, with numerous work by J. A. Scott Kelso (who conducted much early work on coordination dynamics) providing the foundation for the present study and many of the other studies consulted.

While there are many variations of circle tracing tasks, there are two dominant and preferred modes of movement coordination. These are in-phase (same direction, clockwise or anti-clockwise) and anti-phase (opposite direction, inward or outward) (Kelso, Scholz, & Schoner, 1986). The frequency, or speed, at which circles are traced reveals the stability of in-phase and anti-phase movements. At slower speeds, both in-phase and anti-phase movements are stable/sustainable, but when the speed is gradually increased anti-phase movements lose stability (Piek, 1998). From anti-phase, it is common for one hand to involuntarily switch directions to in-phase. This spontaneous switch does not happen when starting in-phase (Piek, 1998). The critical frequency is the point at which stability is lost. During this time an involuntary transition to in-phase movement might occur, as noted above, or one might note sustained phase wandering, meaning the hands are moving in and out of synchronicity.

Based on this information, two circle tracing tasks were chosen for the study. For task one, participants were asked to draw anti-phase circles while incrementally increasing in speed. This was done by attempting to complete one full circle (simultaneously with both hands) in time with an auditory metronome. The auditory metronome started at .8 Hz and increased by .2 Hz every 6 seconds. Assessors marked the time when critical frequency was reached. The test was repeated 3 – 5 times, until a clear average critical frequency emerged. For task two, participants were asked to draw anti-phase circles at a constant speed, and voluntarily switch the direction of their non-dominant hand in response to an audio cue at 13 seconds. The frequency of the auditory metronome was .2 Hz less than the critical frequency determined in task one. Two things were measured in this task: the time it took to initiate movement in the opposite direction with the non-dominant hand, and the time it took from that initiation to reach a stable in-phase pattern. For both tasks participants used pencils to draw circles on paper with a printed circle as a guide. The diameter of the circle was 10 cm, the most commonly used diameter in the literature consulted. All circle tracing tasks were video recorded from above.

### *Blood pressure*

Blood pressure was measured with a standard mercury sphygmomanometer and stethoscope, which is regarded as the gold standard for measuring blood pressure, however it is gradually being replaced by automated measurements which may be more accurate (Pickering et al., 2005). Blood pressure was measured once, on whichever arm the participant preferred. Participants were seated and resting for a few minutes prior to the test.

### *Grip Strength (Hand Grip and Pinch Grip)*

Grip strength was measured with a handheld dynamometer. Participants were instructed to sit down and hold the dynamometer like the handle of a suitcase, hanging down by their side. Participants were instructed to squeeze the dynamometer as hard as they could for three seconds. They repeated this three times for each hand, alternating between hands after each attempt. The maximum force out of three trials was recorded. For community dwelling older adults, handgrip strength has excellent test-retest reliability (ICC = 0.954) (Bohannon & Schaubert, 2005) and for healthy adults excellent intrarater reliability (ICC = 0.94 and 0.98) (Peolsson, 2001) and interrater reliability (ICC = 0.996-0.998) (Lindstrom-Hazel, Kratt, & Bix, 2009).

Pinch grip was measured with a pinch grip dynamometer. Participants were allowed to hold the dynamometer however they saw fit. Participants were instructed to squeeze the dynamometer as hard as they could for three seconds between their thumb and first finger. If any other fingers exerted force then that attempt was not counted. They repeated this three times for each hand, alternating between hands after each attempt. The maximum force out of three trials was recorded. Pinch grip has good intrarater and interrater reliability ( ICC = 0.75 - 0.90) (Shin et al., 2012).

#### *Heart rate*

Resting heart rate was taken manually by using two fingers on the wrist to find the participants' pulse, and counting the number of beats in 15 seconds. Counting for 15 seconds or 30 seconds is equally effective, as long as counting begins on one (not zero) (Hwu, Coates, & Lin, 2000). Heart rate was taken after a few minutes of seated rest. The manual method is the most convenient means for measuring heart rate, however, manually measured readings are not always accurate (Hwu et al., 2000; Leger & Thivierge, 1998). However, this method was used due to limited resources.

### *Lower body strength (30 Second Chair Stand Test)*

The 30 Second Chair Stand Test measures lower extremity strength. Participants were asked to sit in a chair with their feet flat on the floor, approximately shoulder width apart, and arms crossed at the wrists and held against their chest. Participants were instructed to complete as many full stands as possible within 30 seconds, noting that they must stand all the way up, and their bottom must touch the chair each time. Participants were allowed to practice one or two stands if they desired. For community dwelling older adults the 30 Second Chair Stand Test has excellent test-retest reliability (95% Confidence interval 0.79-0.93) and excellent interrater reliability (95% CI = 0.84-0.97) (Jones, Rikli, & Beam, 1999).

### *Manual Dexterity (9 Hole Peg)*

The 9 Hole Peg test measures finger dexterity. Participants were asked to take 9 pegs from a well, one at a time, and place them into 9 holes. Once complete, participants were asked to take them out, one at a time, and place them back into the well. Assessors recorded the time, from touching the first peg to the last peg hitting the well again. Participants repeated the task twice with each hand, and the best score was used. For healthy adults, the 9 Hole Peg has excellent test-retest reliability (ICC = 0.95 for right hand, ICC = 0.92 for left hand) and excellent interrater reliability ( $r = 0.984$  for right hand,  $r = 0.993$  for left hand) (Wang et al., 2011). No research could be found on reliability specifically for healthy older adults.

### *Upper limb range of motion*

Active range of motion (ROM) was measured using a universal goniometer for the shoulder (flexion, extension, abduction), elbow (extension) and wrist (flexion, extension). Participants were instructed to stay within a comfortable range of motion, and stop if experiencing pain. Clinically, the universal

goniometer is the most commonly used tool for measuring passive and active ROM. The reliability of goniometry is dependent on many factors, such as differences among the motions measured, methods of application, and variation among participants (Gajdosik & Bohannon, 1987). Therefore, it is important that standardized methods of testing are adopted. In order to address this, a special session to develop a standardized goniometric practice was held with all of the test administrators.

### **3.3.3.5.2 Cognitive measures**

Participants completed a battery of cognitive tests from CNS Vital Signs, a computerized test battery which utilizes validated neuropsychological tests to evaluate neurocognitive status (Gualtieri & Johnson, 2006). The tests administered were:

- Verbal Memory (VBM) and Visual Memory (VIM): the participant was instructed to remember 15 words (VBM) or shapes (VIM), then identify them amongst 15 new words or shapes. For delayed recognition the test was repeated at the end of the battery.
- Finger Tapping: the participant pressed the space bar with her/his index finger as many times as possible in 10 seconds. The test was repeated three times for each hand.
- Symbol Digit Coding: symbols and numbers were linked in an answer key. A bank of symbols was presented and participants entered the number that corresponded with each symbol.
- Stroop: the Stroop test had three parts. First, the participant pressed the space bar as soon as any word appeared on the screen (reaction time). Second, the participant pressed the space bar when the color of the word matched the name of the word. Third, the participant pressed the space bar when the color of the word did not match the name of the word.
- Shifting Attention: the participant matched geometric objects either by shape or by color.
- Continuous Performance: letters were presented on the screen one by one and the participant pressed the space bar as quickly as possible every time the letter “B” was shown.

These tests were used by the CNS Vital Signs software to calculate scores for the following: composite memory (Verbal and Visual Memory), verbal memory (Verbal Memory), visual memory (Visual Memory), psychomotor speed (Finger Tapping, Symbol Digit Coding), motor speed (Finger Tapping), processing speed (Symbol Digit Coding), reaction time (Stroop), simple attention (Continuous Performance), complex attention (Stroop, Shifting Attention, Continuous Performance), cognitive flexibility (Shifting Attention, Stroop), and executive function (Shifting Attention). The Neurocognition Index (NCI), which represents a global score of neurocognition, was also calculated by taking the average of five domain scores (composite memory, psychomotor speed, reaction time, complex attention, and cognitive flexibility).

Simple attention and its associated test (Continuous Performance Test) was only administered in round 2. This allowed for the addition of the NCI. The rationale behind adding this variable is discussed in Chapter 5.

### **3.3.3.5.3 Emotional measures**

#### *Short Form 36 (SF36)*

Participants self-reported wellbeing with the standard 36-Item Short Form Survey (SF-36). The SF-36 aims to quantify health status, and is often used as a measure of health related quality of life. The eight health concepts, or scales, represented in the survey are: physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, emotional wellbeing, social functioning, energy/fatigue, and general health perceptions (Heinemann, 2010). There is good evidence of test-retest reliability for older adults, and evidence of responsiveness in community dwelling older adults, suggesting that it is sensitive to change (Haywood, Garratt, & Fitzpatrick, 2005).

### 3.3.3.6 Lessons

Having described the protocol behind ethics, participant selection, group allocation, timeline, and measures, it remains that the delivery of the International Poi and Tai Chi lessons be outlined. This section will not discuss the teaching and learning framework (see Chapter 2 and Chapter 5), but rather outline what the lessons entailed in order to provide transparency so that readers can evaluate the soundness of the study and so that the study may be replicated in the future.

The length of the intervention, frequency of lessons, and duration of lessons, were determined by consulting literature on exercise interventions and the limitations of time and money in the present study. Ultimately, a one month intervention in round 1 of the study, and a two month intervention in round 2 of the study, was the maximum duration which could be financially supported. Lessons were 50 minutes long, led by one instructor, with 3 - 12 participants in each lesson. Lessons were held at the University of Auckland Tamaki campus and the University of Auckland Epsom campus.

#### 3.3.3.6.1 International Poi

Participants used International style practice poi, specifically cloth sock poi with pomgrip handles (a soft, ergonomic silicone grip for participants to hold on to). Poi were provided in varying lengths between 16 and 26 inches. There is no standard length for International Poi; it is completely up to the individual practitioner. By providing a variety of lengths, participants could experiment with which length they preferred. The poi were all filled with the same weight (1/2 cup of rice, or 64 grams), but lighter weights were also available for any participants that felt the standard weight was too heavy or fatiguing.



*Figure 4. International Poi used during trial*

Poi lessons were taught by the PI of the present study, a former circus performer with over a decade of International Poi experience. Participants stood in various configurations from lines to a circle facing each other to randomly spread out. A wide variety of upbeat music was played, including New Orleans brass, Nigerian jùjú, and funk.

The first lessons focused on exploring and controlling the timing (same time, split time), plane (wheel plane, wall plane), and direction of the poi. These concepts were explored through certain poi moves such as the figure 8, flowers, butterfly, chasing the sun, and pendulum. Figure 8 (a circle on either side of your body) was chosen as the poi cross the midline, and it is a foundational move and helpful for understanding poi timing and direction. Figure 8 was practiced forward, backward, same time, and split time. Lock outs were also taught (one poi does a figure 8 whilst the other continues spinning in

place). Flowers, or making an arm circle while continuing to spin the poi, were chosen to challenge range of motion. Flowers were most typically practiced one arm at a time, exploring all combinations of arm and poi direction. Flowers were also practiced with two arms. Butterfly (both poi spinning opposite directions, wall plane) was chosen to explore the wall plane and opposite direction spinning. Butterfly was typically practiced same time, and participants were free to spin their poi inwards or outwards. Butterfly behind the head was also taught, primarily with just one hand (whilst the other hand rested) to challenge range of motion. Chasing the sun was taught to challenge balance, as it requires the participant to execute a swift half turn while coordinating her/his poi. Both parts of chasing the sun were taught (resulting in a full turn). Chasing the sun was practiced same time. Pendulum was taught to challenge cognitive flexibility and bimanual coordination. The basic pendulum involved swinging one poi in a full circle while simultaneously letting the other poi swing side to side in a pendulum. Pendulums were also explored as their own movement, and were often used as a warmup and cool down. Most lessons concluded with free time, in which the participant could explore whatever she/he chose.

In round 2 of the study, a poi guide chart was also presented as part of the curriculum, which highlighted the basic principles of timing, direction, and plane, along with showing a simplified version of four tricks (butterfly, pendulum, figure 8, and flower).

### **3.3.3.6.2 Tai Chi**

Tai Chi lessons were taught by Bruno Rubini, a full time Auckland area instructor with over 30 years of Tai Chi Chuan experience. Participants stood in rows facing Rubini, who primarily stayed at the front of the room. The same music, a compilation of songs for meditation, Tai Chi, yoga, relaxation, etc., was played each lesson.

Lessons began with a warm up which involved energizing the joints and silk reeling. Energizing the joints is a series of exercises put together by Rubini, which focused on strengthening the joints and tendons. Silk reeling, Chen Style, focused on movements to connect the upper and lower body. Next, participants were guided through Tai Chi Qigong Shibashi. This section used movements from the Yang style Tai Chi Chuan, with an emphasis on synchronizing 18 movements with proper breathing techniques. Rubini chose the shibashi because:

With experience we know about energy and how to move the meridians, and that certain movements are better. A doctor put [Shibashi] together, trying to simplify [the movements], and it's quite a good one. It is more aimed toward beginner level. In my classes I get into the simple movements first. (B. Rubini, personal communication, December 21, 2017)

During some lessons, Tai Chi walking was also practiced, with a focus on coordinating the upper and lower body. Most lessons concluded with a discussion around various ideas related to Tai Chi philosophy. These discussions were facilitated by Rubini, and shaped by participants' comments and questions. Handouts often accompanied the discussions, including a chart highlighting the 18 movements, which can be seen in Appendix C.

### 3.3.4 Process of analysis

Physical, cognitive, and emotional health were measured at four time points: one month prior to intervention (T0), immediately prior to intervention (T1), immediately post intervention (T2) and one month post intervention (T3). Two baseline measures were made (T0 and T1) to detect any effects of time on the measures prior to beginning the intervention. If there was an effect of time, the measure was considered unstable and was not readily interpreted. For more information on baseline measurements and practice effects, and why a dual baseline approach was taken, see Chapter 5.

For linear, continuous variables that were normally distributed, a repeated measures ANOVA was used with group as a between subject factor and age binarised at the median into young-old (<69 years Tai Chi, <68 poi) and old-old as a covariate. A median split was used because age was not normally distributed. This allowed detection of effects of time, group, and age, and their interactions. Gender was not a useful covariate due to the low number of men. For ordinal or non-normally distributed data, appropriate non-parametric tests were used, such as Wilcoxon Rank Sum. A modified Bonferroni correction was used for multiple comparisons (Rom, 1990).

## 3.4 Follow-up questionnaires

### 3.4.1 Introduction

The following section will outline the methodological considerations and protocols behind the follow-up questionnaires. The overarching purpose of the questionnaires was to systematically augment the clinical study data. This may provide the researcher with greater explanatory power, shed light on data trends, and illuminate qualities which set International Poi apart from Tai Chi.

### 3.4.2 Methodological considerations and protocol

The primary goal of augmenting the clinical study data determined the design and process of analysis for the questionnaires. Rather than use the questionnaires to make personal meaning, as is common with qualitative data, they were used to clarify the clinical study data. Therefore the questionnaires are tightly connected to the clinical study in terms of purpose and form. Before discussing the

methodological considerations and protocols of each questionnaire, a few limiting factors will be discussed.

The first limitation was participants' time. In order to maximize the potential of recruiting a large number of participants, the total hours required to take part in the study was kept as minimal as possible without compromising study quality. With the test sessions taking up to an hour and a half each, it was necessary to keep any additional procedures brief. This meant that structured interviews or long questionnaires, for example, were not considered. The second limitation was the researcher's time. The hours required to conduct the clinic study did not leave room for more time intensive follow ups such as case studies. The final limitation was money. If given a budget to hire additional staff or better compensate participants, for example, perhaps some of the aforementioned methods could have been utilized. However, a limited budget precluded this possibility. Given these limitations, and the overarching goal of supporting the clinical study, each questionnaire will now be discussed.

#### 3.4.2.1 Questionnaire 1 (Q1)

The purpose of Q1 was to determine participants' physical activity level prior to beginning the study. By collecting this data the overall exercise level of each group could be determined. This allowed us to better understand if physical improvements seen in the present study were due to the specific interventions, or due to increased physical activity in general. For example, if the majority of participants were not physically active prior to the intervention, then just getting up and moving (irrespective of the activity), might produce benefits. These data also allowed us to determine if the International Poi group and Tai Chi group were relatively similar in overall exercise levels. It should be noted that this questionnaire was administered one month post intervention, and only in round 2 of the study, as determining physical activity level did not occur to the PI prior to this point.

### 3.4.2.1.1 Data collection procedures

There are a number of standardized questionnaires to determine the physical activity level of older adults, such as the Physical Activity Scale for the Elderly and the Yale Physical Activity Survey (Stewart et al., 2011). In order to keep the amount of time required down to a minimum, the following questionnaire was developed based on a study by Gill, Jones, Zou, and Speechley (2012). The final questionnaire developed for the present study is as follow.

Think back to the 6 months before this study began, August - January 2017. What were you up to then? What activities were you involved in?

During that 6 months, which of the following best describes your activity level during an average week? (circle one)

- **Vigorously active** for at least 30 minutes, 3 times a week  
(For example hiking, jogging, carrying heavy loads, shoveling, bicycling fast, swimming laps, heavy gardening)
- **Moderately active** at least 3 times a week  
(For example walking briskly, heaving cleaning such as vacuuming or mopping, general gardening, slow dancing)
- **Seldom active**  
(less active than the above)

*Figure 5. Questionnaire 1*

Data from Q1 was simply tallied to show the total number of responses in each category, for each group.

### 3.4.2.2 Questionnaire 2 (Q2)

The purpose of Q2 was to capture participants' reactions to the intervention, in order to gain a richer understanding of their experience and therefore augment the clinical study and provide the researcher with greater explanatory power. Q2 consisted of one open ended question: what three

words best describe how you are feeling? Limiting responses to three words enabled participants to hone in on their most prominent feelings, distilling their experience down to a clear and concise response. One word responses also allowed for clean word cloud data visualization. Word clouds, or tag clouds, are a means of presenting a visual overview of a collection of words (Cui et al., 2010; Henderson & Segal, 2013). The more times a word is used, the larger the word appears, thus giving viewers a quick overview of shared sentiments and themes in the data (Viégas & Wattenberg, 2008).

By asking this question after every lesson, trends regarding learning curves and participants' experience over time may be illuminated. This information may be helpful if future research investigates flow state and the relationship between challenge and enjoyment. As stated by Mihaly Csikszentmihalyi (1990),

The best moments in our lives are not the passive, receptive, relaxing times...The best moments usually occur if a person's body or mind is stretched to its limits in a voluntary effort to accomplish something difficult and worthwhile. (p. 3)

Data from Q2 may also be useful for comparing and contrasting International Poi and Tai Chi, and the overall experience of each group.

#### **3.4.2.2.1 Data collection procedures**

After each International Poi and Tai Chi lesson, participants answered the following question: what three words best describe how you're feeling? These words were written down anonymously on a post-it note, and stuck to the wall after each lesson in round 1 of the study, or stuck in a notebook after each lesson in round 2 of the study. Responding to this question was always done immediately after each lesson, before participants began packing up, chatting, etc., in an attempt to elicit the most

genuine response. In both rounds, participants had access to the post-it notes from their own cohort and also the other group (so those attending poi lessons could see the post-it notes of those practicing Tai Chi, and vice versa). The data collection procedures described here were not modelled on a standardized practice, as the process was unique to the present study.

#### **3.4.2.2.2 Process of analysis**

An emic approach to the analysis of the data generated by Questionnaire 2 was utilized. That is, every attempt was made to let meaning emerge from the participants themselves, rather than from the PI or some pre-existing theory (van de Vijver, 2010). It should be noted that follow-up in-depth interviews of the participants would have given an additional emic robustness to the analysis of Q2 data, but these were not possible due to time and financial constraints.

Words from the post-it notes were typed and alphabetized. If any words were the same but either plural/singular or in a different tense, the most used form of the word was chosen and the other words were converted (for example, “relaxing” was changed to “relaxed”, as the majority of participants used the past tense). If a phrase was written instead of one word, it was distilled down to one word if possible (for example “I feel relaxed” became “relaxed”) or left as a phrase if all the words were important to the core idea (for example “all in the same boat” and “baby steps” were left as phrases). A free online word cloud generator, <http://www.wordclouds.com/>, was used to turn the data into the final visualization. This generator was chosen as it is free and easy to use.

### 3.4.2.3 Questionnaire 3 (Q3)

The rationale behind Q3 was to gather data on participants' perceived effects, positive and/or negative, of the intervention. This data may illuminate any underlying bias of participants' psychological states, which may have affected the clinical study outcomes. It also gives us a broader understanding of the potential impact of the intervention. Q3 consisted of one closed-ended rating scale question, and three open-ended questions.

#### 3.4.2.3.1 Data collection procedures

Questionnaire 3 was administered immediately after the last intervention period. Both the International Poi and Tai Chi group received the same questions, but the activity mentioned in the questions was changed accordingly. For the purposes of this thesis, "poi/Tai Chi" has been used.

<p>1. Reflecting on the past month, how much progress do you feel you made learning poi/Tai Chi? (circle one)</p> <p style="text-align: center;">little progress    some progress    lots of progress</p> <p>2. Did you experience any negative effects (for example muscle or joint soreness, pain, stress, etc.) which seemed to be caused by practicing poi/Tai Chi? If so, please explain.</p> <p>3. Did you experience any positive effects which seemed to be caused by practicing poi/Tai Chi? If so, please explain.</p> <p>4. Is there anything else you would like to share about your experience?</p>
--

*Figure 6. Questionnaire 3*

#### 3.4.2.3.2 Process of analysis

Question 1. from Q3 (Reflecting on the past month, how much progress do you feel you made learning poi/Tai Chi?) was aggregated. For the remaining Q3 questions (Did you experience any

negative effects? Did you experience any positive effects? Is there anything else you would like to share about your experience?) a descriptive phenomenological method (chunking/grouping) was used to examine trends and common themes, such that the data reflect increasingly broader perspectives (Creswell, 2003; Creswell, Hanson, Clark Plano, & Morales, 2007, Miles & Huberman, 1994). The data were “grouped” or “chunked” (Merriam & Tisdell, 2015) using the constant comparative method, wherein pieces of data are compared to one another in order to discern similarities and differences. Data were first grouped into three overarching categories (physical, cognitive, or emotional), as these directly reflect the categories for quantitative data collection. From there, the aforementioned methods were used to further divide the data into sub-categories. If a single response covered more than one category, that response was broken up accordingly. For example, the response “more relaxed and more at peace” was broken up into “more relaxed” and “more at peace” to fit into separate categories accordingly.

#### 3.4.2.4 Questionnaire 4 (Q4)

The rationale behind Q4 was to gather data on participants’ continued engagement with the intervention activity, outside of the present study. Understanding the likelihood of a participant to engage with the intervention on her or his own time provides valuable insights. If a participant does not want to, or does not enjoy, engaging with an activity, she/he are much less likely to do so (Csikszentmihalyi, 1996). Q4 consisted of two dichotomous questions, with the option of expounding.

##### 3.4.2.4.1 Data collection procedures

Questionnaire 4 was administered one month after the intervention period, as part of the last post-test. Both the International Poi and Tai Chi group received the same questions, but the activity

mentioned in the questions was changed accordingly. For the purposes of this thesis, “poi/Tai Chi” has been used.

Have you practiced poi/Tai Chi since completing your lessons in the study?
yes    no
Comments:
Would you like to continue your poi/Tai Chi practice in the future?
yes    no
Comments:

*Figure 7. Questionnaire 4*

Data from both questions were simply tallied to show the total number of “yes” or “no” responses for each group.

### 3.5 Summary

This chapter described the methodology and methods of the present study. It began by discussing the philosophical assumptions and/or theories which lay the foundation for this research, specifically axiology (the study of value), ontology (the nature of reality), and epistemology (the nature of knowledge). It continued by detailing the methodology, protocols, and process of analysis for both the clinical study and the follow-up questionnaires. For the clinical study, the process of deciding the treatment group activity (International Poi), control group activity (Tai Chi), and the pre- and post-test variables and means of measuring were discussed at length. The protocol for the test sessions and intervention period was described, along with the process for data analysis. For the follow-up questionnaires the overarching purpose along with the rationale, methods, and protocol behind each

questionnaire was discussed. The overarching purpose of this chapter was to provide transparency so that readers can evaluate the soundness of the philosophical assumptions, study protocols, and data collection and analysis methods. This chapter also aimed to provide sufficient detail for replication of this study.

# 4. Results

## 4.1 Introduction

The following chapter provides the results of the first study to scientifically investigate the effects of poi on health in healthy older adults. It will first report the clinical study results, beginning with participant information and moving through three time periods: T0 (one month prior to intervention) to T1 (immediately prior to intervention), T1 (immediately prior to intervention) to T2 (immediately post intervention), and T2 (immediately post intervention) to T3 (one month post intervention). It will then report the questionnaire results, presenting the raw data or a data visualization when appropriate.

## 4.2 Clinical study

### 4.2.1 Participants

The study sample flow is shown in Figure 8. A total of 226 participants were screened. One hundred and thirty did not meet the inclusion criteria. Ninety-six completed pre-test one and were randomized. Seventeen participants withdrew due to health problems, schedule conflicts, family issues, and a stolen car, leaving data from 79 participants available for analysis.

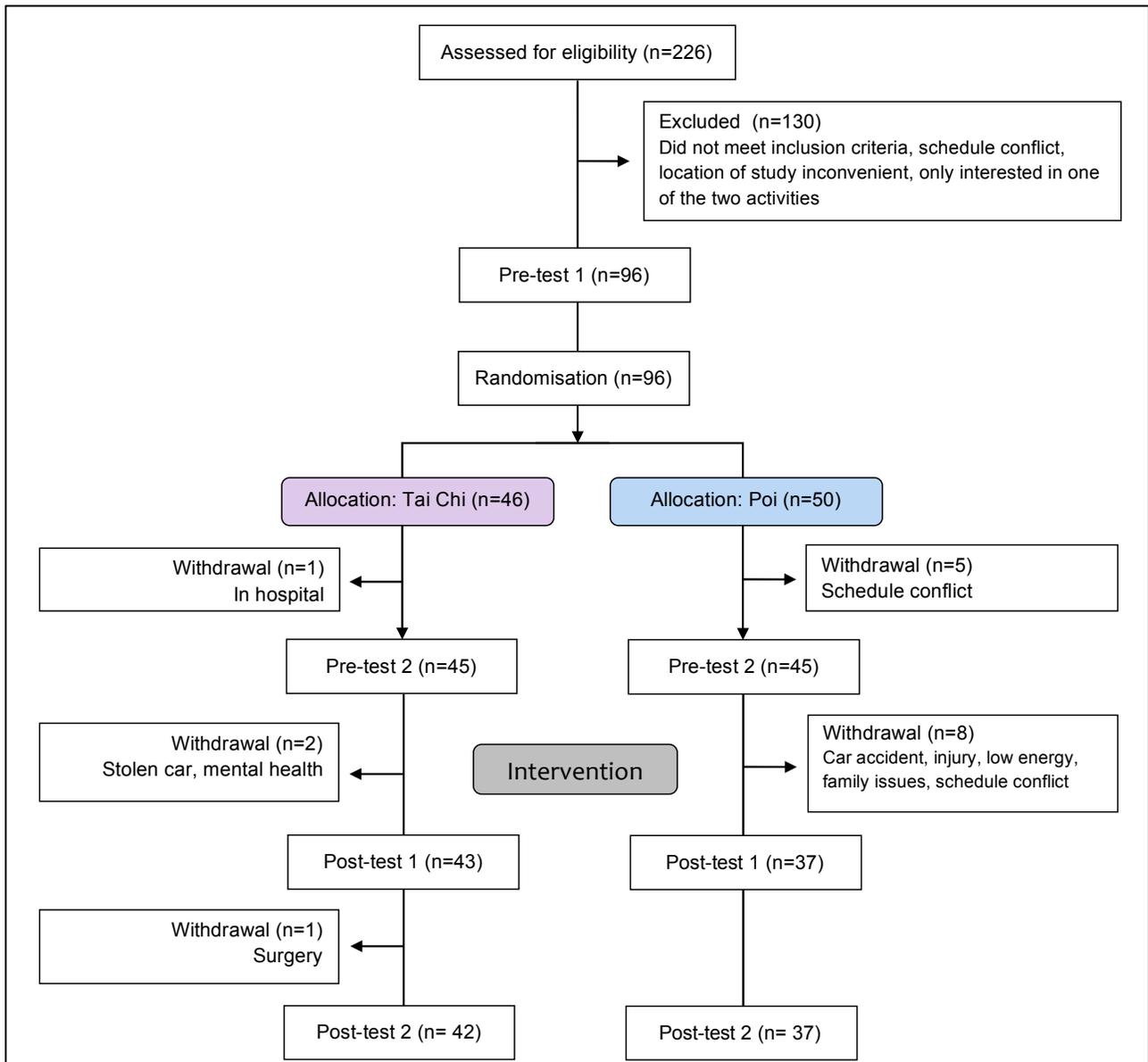


Figure 8. Flowchart of the clinical study

The study was completed in two rounds. Round one had 37 participants available for analysis (18 poi, 19 Tai Chi) and round two had 42 participants available for analysis (18 poi, 24 Tai Chi). For both International Poi and Tai Chi, the mean number of completed lessons was 7, with a range of 5 – 8. Because there was low variability in the number of lessons attended, a relationship between how many classes were attended and outcome scores was not explored.

## 4.2.2 Baseline

Baseline characteristics of the randomized participants are provided in Table 6. Mean age was 67.6 years in the poi group, with 29 women and 7 men. Mean age was 69.1 years in the Tai Chi group, with 32 women and 11 men.

For both groups, the following physical measures improved between T0 and T1: 30 Second Chair Stand Test ( $F_{1,74} = 37.5, P < 0.001$ ), critical frequency for bimanual coordination ( $F_{1,76} = 10.8, P = 0.002$ ), and elbow range of motion ( $F_{1,58} = 10.9, P = 0.002$ ). It should be noted that upper limb range of motion results represent the sum across both limbs. For both groups, the following cognitive measures improved between T0 and T1: cognitive flexibility ( $F_{1,74} = 7.2, P = 0.009$ ), complex attention ( $F_{1,37} = 5.9, P = 0.020$ ), executive function ( $F_{1,74} = 10.8, P = 0.002$ ), psychomotor speed ( $F_{1,73} = 9.2, P = 0.003$ ), motor speed ( $F_{1,76} = 11.8, P = 0.001$ ), and reaction time ( $F_{1,74} = 10.5, P = 0.002$ ). These improvements were most likely due to the effects of practice.

There was a between-group difference in diastolic blood pressure at T0, as the mean was lower for Tai Chi (72.6 mm Hg) than for poi (77.8 mm Hg,  $P = 0.037$ ). There was an interaction between time and group for diastolic blood pressure between T0 and T1 ( $F_{1,72} = 6.4, P = 0.014$ ). The interaction arose because diastolic blood pressure decreased for the poi group ( $M = -4.3$  mm Hg,  $SD = 8.5$  mm Hg), but not the Tai Chi group ( $M = .60$  mm Hg,  $SD = 8.4$  mm Hg). There was also an interaction between time and age for verbal memory between T0 and T1 ( $F_{1,75} = 4.29, P = 0.042$ ). The interaction arose because the old-old (> 69 years,  $M = .1.2, SD = 3.97$ ) improved more than the young-old ( $M = -1.7, SD = 3.99, T_{76} = 0.037$ ). The variables which improved between T0 and T1 are

not readily analyzed moving forward, as improvement was likely due to effects of practice. All measures not mentioned above were similar between T0 and T1.

### Baseline characteristics of participants

DEMOGRAPHICS		
	Poi (N = 36)	Tai Chi (N = 43)
<b>Age</b>		
Mean (range)	67.6 (60-80)	69.1 (60-86)
Between group p-value	0.214	
<b>Gender</b>		
Female, n (%)	29 (80.5%)	32 (74.4%)
Male, n (%)	7 (19.4%)	11 (25.6%)
Between group p-value	0.569	

PHYSICAL: RM-ANOVA									
	Mean T0		Mean T1		P-Values				Sample size
	Poi	Tai Chi	Poi	Tai Chi	Time	Group	Time* Group	Difference between groups at T0	
<b>Cardiovascular function</b>									
Systolic blood pres. (mmHg)	124.7	118.3	122.3	121.2	0.642	0.158	0.111	0.068	75
Diastolic blood pres. (mmHg)	77.8	72.6	73.1	73.1	0.073	0.253	<b>0.014</b>	<b>0.037</b>	75
Heart rate (bpm)	67.2	70.8	67.3	69.7	0.591	0.199	0.515	0.167	79
<b>Balance</b>									
4 stage balance (max=20)	15.3	14.8	15.6	15.0	0.403	0.239	0.986	0.356	42
Functional reach (mm)	55.9	58.5	52.3	56.4	0.094	0.656	0.677	0.517	79
<b>Strength</b>									
Hand grip (lbs)	114.9	121.4	114.0	121.3	0.491	0.406	0.622	0.416	79
Pinch grip (lbs)	17.2	17.6	17.9	18.2	0.093	0.65	0.596	0.710	79
Chair stand (n of stands)	15.8	16.7	18.0	18.6	<b>0.000</b>	0.642	0.447	0.504	77
<b>Coordination</b>									
9 hole peg (seconds)	38.3	38.9	37.9	38.5	0.438	0.839	0.769	0.615	78
Critical frequency (bpm)	104.3	100.7	109.5	107.4	<b>0.002</b>	0.656	0.677	0.549	79

<b>Upper limb range of motion*</b>									
Shoulder ROM (degrees)	777.3	783.7	768.8	779.5	0.372	0.123	0.735	0.675	79
Elbow ROM (degrees)	290.8	289.6	293.4	293.8	<b>0.002</b>	0.503	0.992	0.694	78
Wrist ROM (degrees)	280.7	289.0	279.5	287.6	0.859	0.287	0.923	0.237	78

<b>COGNITIVE (CNS VITAL SIGNS BATTERY): RM-ANOVA</b>									
	<b>Mean T0</b>		<b>Mean T1</b>		<b>P-Values</b>				<b>Sample size</b>
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Time</i>	<i>Group</i>	<i>Time* Group</i>	<i>Difference between groups at T0</i>	
<b>Memory</b>									
Composite memory	97.6	97.1	98.2	97.9	0.388	0.606	0.852	0.769	76
Verbal memory	52.9	52.0	53.3	52.8	0.421	0.371	0.895	0.410	78
Visual memory	44.8	44.8	45.0	45.1	0.668	0.882	0.882	0.954	78
<b>Flexibility</b>									
Cognitive flexibility	37.2	39.3	41.2	43.6	<b>0.009</b>	0.335	0.927	0.426	77
<b>Attention</b>									
Simple attention	39.2	39.4	39.8	39.6	0.093	0.796	0.353	0.696	40
Complex attention**	9.3	7.9	7.5	6.1	<b>0.020</b>	0.355	0.778	0.507	40
<b>Executive function</b>									
Executive function	38.5	40.4	41.2	45.7	<b>0.002</b>	0.218	0.425	0.488	77
<b>Speed</b>									
Psychomotor speed	153.8	148.7	160.3	155.0	<b>0.003</b>	0.203	0.928	0.327	76
Motor speed	104.9	101.9	111.4	106.7	<b>0.001</b>	0.254	0.621	0.478	79
Processing speed	45.0	45.1	47.7	46.6	0.070	0.784	0.921	0.967	77
Reaction time**	755.7	737.5	724.3	721.6	<b>0.002</b>	0.588	0.465	0.408	77
<b>Overall NCI Score</b>									
NCI	211.1	199.8	207.7	200.0	0.196	0.084	0.157	<b>0.043</b>	38

<b>EMOTIONAL (SF-36): FRIEDMAN'S TWO-WAY ANOVA</b>									
	<b>Mean T0</b>		<b>Mean T1</b>		<b>P-Values</b>				<b>Sample size</b>
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Difference between groups at T0</i>	<i>Difference between T0 and T1 across group</i>			

Physical functioning	85.43	83.67	85.14	82.33	0.498	0.181	79
Role limitations: physical	84.29	83.14	84.72	87.21	0.360	0.127	79
Role limitations: emotional	89.51	83.79	83.33	86.09	0.203	0.847	79
Energy/fatigue	70.0	65.6	68.3	66.0	0.099	0.900	79
Emotional wellbeing	86.63	81.21	84.44	82.14	<b>0.040</b>	0.696	79
Social functioning	95.4	91.7	92.8	93.5	0.223	0.705	79
Pain	81.1	82.1	83.9	85.4	0.698	0.070	79
General health	80.0	75.7	79.4	74.4	0.960	0.617	79
Health change	55.7	54.1	61.8	54.1	0.706	0.297	79

\*Upper limb ROM represents the sum across both limbs

\*\* Denotes that a lower score is better; higher scores are better for all other cognitive tests

Table 6. Baseline characteristics of participants

### 4.2.3 Immediately post intervention

For both groups, three physical measures and one cognitive measure showed no practice effects between T0 and T1, and improved between T1 and T2: 4-Stage Balance Test ( $F_{1,39} = 9.9$ ,  $P = 0.003$ ), Functional Reach Test ( $F_{1,76} = 7.5$ ,  $P = 0.008$ ), hand grip ( $F_{1,76} = 11.6$ ,  $P = 0.001$ ), and simple attention ( $F_{1,38} = 4.6$ ,  $P = 0.038$ ). For both groups, two cognitive measures showed no practice effects between T0 and T1 and declined between T1 and T2: composite memory ( $F_{1,76} = 7.8$ ,  $P = 0.001$ ) and visual memory ( $F_{1,76} = 8.8$ ,  $P = 0.002$ ). There were no effects of group, and no interactions between group and time, for these measures.

There was an interaction between time and group for systolic blood pressure ( $F_{1,76} = 4.3$ ,  $P = 0.041$ ). The interaction arose because systolic blood pressure decreased for the Tai Chi group ( $M = -5.1$  mm Hg,  $SD = 12.7$  mm Hg,  $T_{77} = 2.25$ ), but not the poi group ( $M = 2.2$  mm Hg,  $SD = 16.3$  mm Hg). There was an interaction between time and age for simple attention ( $F_{1,38} = 10.2$ ,  $P = 0.003$ ). The interaction

arose because the young-old (< 69 years, M = .88, SD = 1.3) improved more than the old-old (M = 0.16, SD = .80,  $T_{39} = 3.5$ ).

There were also significant effects of time on elbow range of motion, 30 Second Chair Stand Test, critical frequency, complex attention, cognitive flexibility, psychomotor speed, and executive function between T1 and T2. However, these are not readily interpreted due to practice effects between T0 and T1 (Table 7).

### T1 – T2 Results

PHYSICAL: RM-ANOVA								
	Mean T1		Mean T2		P-Values			Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Time</i>	<i>Group</i>	<i>Time* Group</i>	
<b>Cardiovascular function</b>								
Systolic blood pres. (mmHg)	122.3	121.2	124.5	116.7	0.452	0.090	<b>0.041</b>	79
Diastolic blood pres. (mmHg)	73.1	73.1	74.7	73.0	0.349	0.850	0.590	79
Heart rate (bpm)	67.3	69.7	66.1	67.2	0.056	0.435	0.501	79
<b>Balance</b>								
4 stage balance (max=20)	15.6	15.0	15.9	15.7	<b>0.003</b>	0.139	0.423	42
Functional reach (mm)	52.3	56.4	56.1	59.0	<b>0.008</b>	0.294	0.570	79
<b>Strength</b>								
Hand grip (lbs)	114.0	121.3	120.0	126.7	<b>0.001</b>	0.383	0.869	79
Pinch grip (lbs)	17.9	18.2	19.0	18.4	0.054	0.937	0.109	79
Chair stand (n of stands)	18.0	18.6	19.7	19.1	<b>0.003</b>	0.883	0.175	76
<b>Coordination</b>								
9 hole peg (seconds)	37.9	38.5	37.2	38.3	0.183	0.456	0.402	79
Critical frequency (bpm)	109.5	107.4	111.3	112.2	0.057	0.953	0.395	79
<b>Upper limb range of motion</b>								
Shoulder ROM (degrees)	768.8	779.5	780.0	778.0	0.320	0.663	0.182	79
Elbow ROM (degrees)	293.4	293.8	297.7	297.6	<b>0.004</b>	0.869	0.722	79
Wrist ROM (degrees)	279.5	287.6	278.3	290.5	0.752	0.087	0.510	78

COGNITIVE (CNS VITAL SIGNS BATTERY): RM-ANOVA								
	Mean T1		Mean T2		P-Values			Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Time</i>	<i>Group</i>	<i>Time* Group</i>	
<b>Memory</b>								
Composite memory	98.2	97.9	95.2	95.0	<b>0.001</b>	0.873	0.918	79
Verbal memory	53.3	52.8	52.0	52.1	0.106	0.831	0.584	79
Visual memory	45.0	45.1	43.2	42.9	<b>0.002</b>	0.952	0.714	79
<b>Flexibility</b>								
Cognitive flexibility	41.2	43.6	45.7	45.1	<b>0.025</b>	0.682	0.243	79
<b>Attention</b>								
Simple attention	39.8	39.6	40.0	39.8	<b>0.038</b>	0.243	0.870	41
Complex attention**	7.5	6.1	5.0	5.6	<b>0.04</b>	0.889	0.185	41
<b>Executive function</b>								
Executive function	41.2	45.7	45.8	47.2	<b>0.019</b>	0.186	0.175	79
<b>Speed</b>								
Psychomotor speed	160.3	155.0	163.3	159.1	<b>0.010</b>	0.297	0.914	78
Motor speed	111.4	106.7	113.2	107.9	0.119	0.108	0.852	79
Processing speed	47.7	46.6	48.4	49.4	0.184	0.843	0.312	78
Reaction time**	724.3	721.6	716.0	719.9	0.585	0.994	0.637	78
<b>Overall NCI Score</b>								
NCI	207.7	200.0	200.6	202.2	0.236	0.532	0.082	40

EMOTIONAL (SF-36): FRIEDMAN'S TWO-WAY ANOVA						
	Mean T1		Mean T2		Difference between T1 and T2 across group	Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>		
Physical functioning	85.1	82.3	88.6	82.3	0.15	78
Role limitations: physical	84.7	87.2	88.2	86.6	0.67	78
Role limitations: emotional	83.3	86.1	90.0	88.1	0.05	78
Energy/fatigue	68.3	66.0	72.9	68.6	0.28	78
Emotional wellbeing	84.4	82.1	87.6	83.0	0.10	78
Social functioning	92.8	93.5	96.6	90.8	0.59	78
Pain	83.9	85.4	83.7	79.7	0.34	78

General health	79.4	74.4	81.5	76.2	0.90	78
Health change	61.8	54.1	66.7	53.5	0.37	78

\*Upper limb ROM represents the sum across both limbs

\*\* Denotes that a lower score is better; higher scores are better for all other cognitive tests

Table 7. T1 – T2 results

#### 4.2.4 One month post Intervention

One month post intervention, 25 Tai Chi participants had continued their practice, 17 had not, and 20 poi participants had continued their practice, 16 had not. For both groups, two physical measures and three cognitive measures had no practice effects between T0 and T1, and improved between T2 and T3: hand grip ( $F_{1,75} = 4.9$ ,  $P = 0.029$ ), shoulder ROM ( $F_{1,75} = 10.6$ ,  $P = 0.002$ ), composite memory ( $F_{1,73} = 10.3$ ,  $P = 0.002$ ), visual memory ( $F_{1,73} = 6.3$ ,  $P = 0.014$ ) and verbal memory ( $F_{1,75} = 4.2$ ,  $P = 0.043$ ). There were no effects of group, and no interactions between group and time, for these measures. It should be noted that upper limb range of motion results represent the sum across both limbs.

There was an interaction between time and group for systolic blood pressure ( $F_{1,75} = 7.4$ ,  $P = 0.008$ ). The interaction arose because systolic blood pressure decreased for the poi group ( $M = -5.05$  mm Hg,  $SD = 14.4$  mm Hg,  $T_{76} = -2.47$ ), but not the Tai Chi group ( $M = 3.71$  mm Hg,  $SD = 13.75$  mm Hg).

There were also significant effects of time on elbow ROM and psychomotor speed between T2 and T3. However, these are not readily interpreted due to practice effects between T0 and T1 (Table 8).

#### T2 – T3 Results

PHYSICAL: RM-ANOVA								
	Mean T2		Mean T3		P-Values			Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Time</i>	<i>Group</i>	<i>Time* Group</i>	
<b>Cardiovascular function</b>								
Systolic blood pres. (mmHg)	124.5	116.7	119.4	120.8	0.649	0.245	<b>0.008</b>	78
Diastolic blood pres. (mmHg)	74.7	73.0	72.6	74.6	0.716	0.937	0.078	78
Heart rate (bpm)	66.1	67.2	67.3	68.19	0.238	0.703	0.987	78
<b>Balance</b>								
4 stage balance (max=20)	15.9	15.7	15.9	15.9	0.303	0.301	0.279	41
Functional reach (mm)	56.1	59.0	56.1	58.8	0.993	0.392	0.987	78
<b>Strength</b>								
Hand grip (lbs)	120.0	126.7	121.4	132.3	<b>0.029</b>	0.295	0.213	78
Pinch grip (lbs)	19.0	18.4	19.0	19.4	0.147	0.968	0.177	78
Chair stand (n of stands)	19.7	19.1	20.1	19.2	0.214	0.526	0.794	76
<b>Coordination</b>								
9 hole peg (seconds)	37.2	38.3	36.7	37.6	0.067	0.361	0.679	78
Critical frequency (bpm)	111.3	112.2	111.7	107.1	0.164	0.818	0.103	78
<b>Upper limb range of motion</b>								
Shoulder ROM (degrees)	780.0	778.0	799.5	790.5	<b>0.002</b>	0.594	0.507	78
Elbow ROM (degrees)	297.7	297.6	292.6	295.8	<b>0.010</b>	0.541	0.174	78
Wrist ROM (degrees)	278.3	290.5	281.7	281.8	0.868	0.195	0.454	77

COGNITIVE (CNS VITAL SIGNS BATTERY): RM-ANOVA								
	Mean T2		Mean T3		P-Values			Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>	<i>Time</i>	<i>Group</i>	<i>Time* Group</i>	
<b>Memory</b>								
Composite memory	95.2	95.0	98.1	97.8	<b>0.002</b>	0.88	0.996	76
Verbal memory	52.0	52.1	53.0	53.3	<b>0.043</b>	0.850	0.871	78
Visual memory	43.2	42.9	45.0	44.5	<b>0.014</b>	0.696	0.998	76
<b>Flexibility</b>								
Cognitive flexibility	45.7	45.1	47.2	47.8	0.091	0.968	0.580	40
<b>Attention</b>								
Simple attention	40.0	39.8	40.0	39.7	0.731	0.146	0.761	40
Complex attention**	5.0	5.6	4.2	4.7	0.117	0.399	0.756	40

<b>Executive function</b>								
Executive function	45.8	47.2	48.0	48.9	0.339	0.460	0.814	77
<b>Speed</b>								
Psychomotor speed	163.3	159.1	164.5	162.7	<b>0.003</b>	0.586	0.296	77
Motor speed	113.2	107.9	113.7	109.0	0.227	0.128	0.698	78
Processing speed	48.4	49.4	47.8	48.6	53.790	0.211	0.170	37
Reaction time**	716.0	719.9	732.7	706.8	713.96	0.756	0.927	76
<b>Overall NCI Score</b>								
NCI	200.6	202.2	203.2	200.9	202.73	0.682	0.925	37

EMOTIONAL (SF-36): FRIEDMAN'S TWO-WAY ANOVA						
	Mean T2		Mean T3		Difference between T2 and T3 across group	Sample size
	<i>Poi</i>	<i>Tai Chi</i>	<i>Poi</i>	<i>Tai Chi</i>		
Physical functioning	88.6	82.3	88.2	79.6	0.796	78
Role limitations: physical	88.2	86.6	86.8	80.4	0.371	78
Role limitations: emotional	90.0	88.1	88.9	88.1	0.467	78
Energy/fatigue	72.9	68.6	71.1	67.9	0.903	78
Emotional wellbeing	87.6	83.0	85.2	84.9	0.686	78
Social functioning	96.6	90.8	93.5	85.5	0.250	78
Pain	83.7	79.7	82.6	81.6	0.258	78
General health	81.5	76.2	80.1	73.7	0.431	78
Health change	66.7	53.5	63.2	53.6	0.670	78

\*Upper limb ROM represents the sum across both limbs

\*\* Denotes that a lower score is better; higher scores are better for all other cognitive tests

Table 8. T2 – T3 results

## 4.3 Follow-up questionnaires

The following section will report the questionnaire results, presenting the raw data or a data visualization when appropriate.

### 4.3.1 Q1

**Q1.** Prior to beginning this study, how physically active were you?

The numbers represent the number of responses.

	Vigorously active	Moderately active	Seldom active
Poi	5	10	2
Tai Chi	4	16	3

*Table 9. Q1 responses*

### 4.3.2 Q2

Q2 was administered after each lesson. Raw data is presented in appendix D.

**Q2.** What three words best describe how you are feeling?



week three

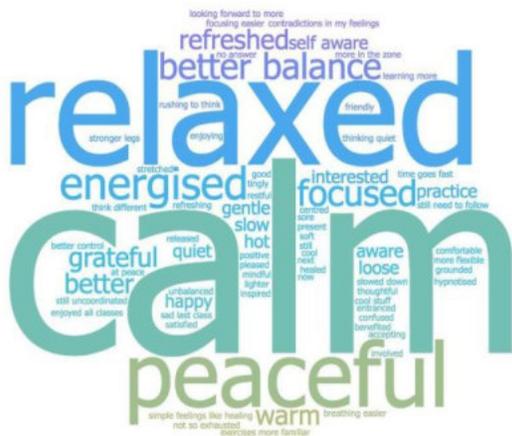


Tai Chi



Poi

week four



Tai Chi



Poi

Figure 9. Word clouds by week

International Poi (all 4 weeks)





	Little progress	Some progress	Lots of progress
Poi	0	11	23
Tai Chi	1	28	12

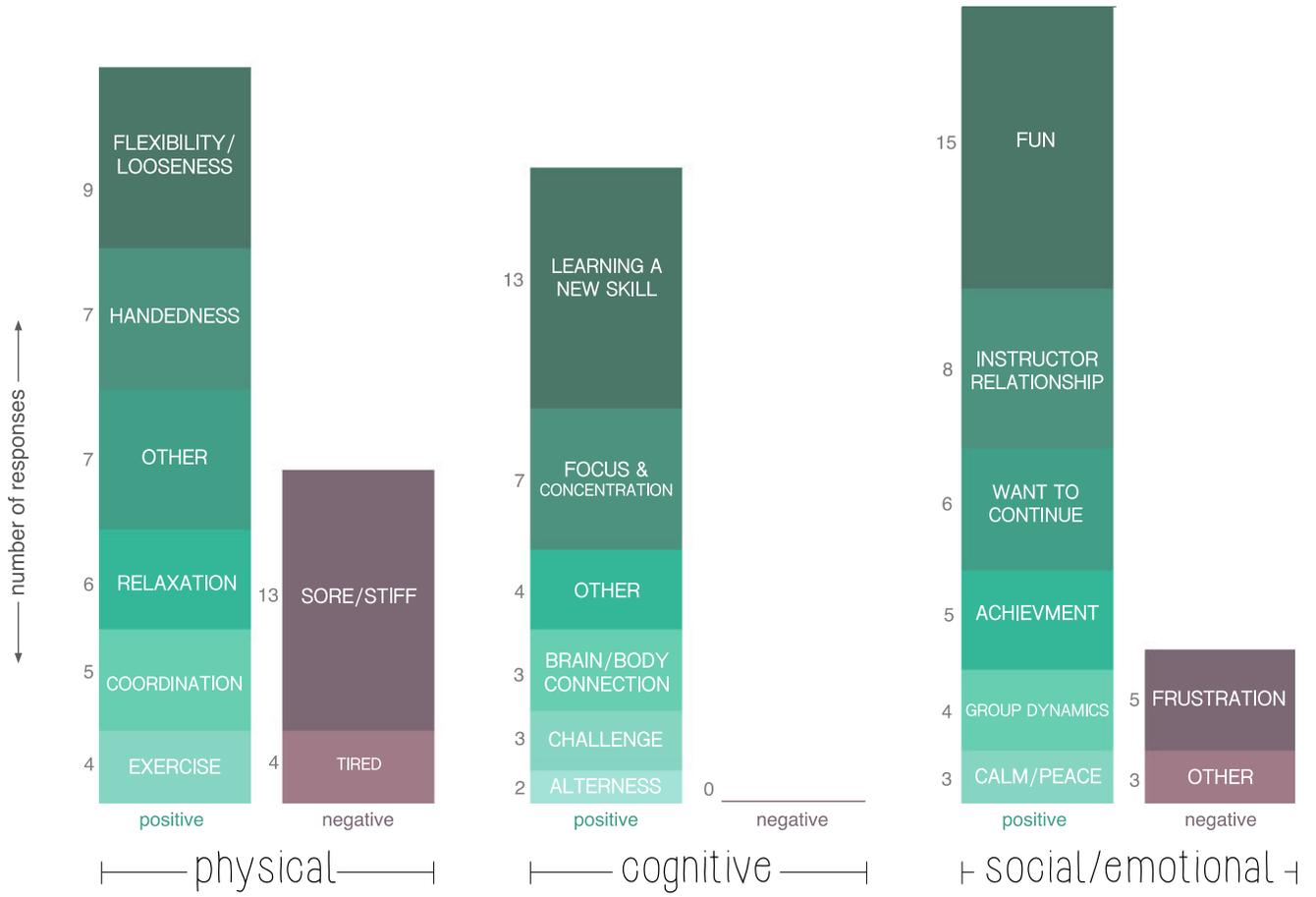
*Table 10. Q3 question 1 responses*

**Q3. Question 2:** Did you experience any negative effects which seemed to be caused by practicing poi/Tai Chi? If so, please explain.

**Q3. Question 3:** Did you experience any positive effects which seemed to be caused by practicing poi/Tai Chi? If so, please explain.

**Q3. Question 4:** Is there anything else you would like to share about your experience?

# International Poi



# physical

FLEXIBILITY/ LOOSENESS	<ul style="list-style-type: none"> <li>"Doing poi seems to loosen up the stiffness in my back, shoulders, and neck"</li> <li>"I think my flexibility in my wrist has improved"</li> </ul>
HANDEDNESS	<ul style="list-style-type: none"> <li>"I have gained strength and direction in my left hand and arm which I noticed when sawing through a heavy tree branch"</li> <li>"Made me more aware of using my left hand, now try to do more with my it like making a coffee, opening fridge door"</li> </ul>
OTHER <small>(muscle tone, sleep, posture, balance, weight loss, peripheral vision, shaking hand)</small>	<ul style="list-style-type: none"> <li>"I think spinning poi is improving my peripheral vision and balance"</li> <li>"Upper arms firming up"</li> </ul>
RELAXATION	<ul style="list-style-type: none"> <li>"Generally relaxed after a lesson"</li> <li>"Even though I am concentrating on what I am trying to achieve with each move, I find it quite relaxing"</li> </ul>
COORDINATION	<ul style="list-style-type: none"> <li>"I am positive that my coordination has improved since starting"</li> <li>"Poi is a gentle way at regaining some more coordination"</li> </ul>
EXERCISE	<ul style="list-style-type: none"> <li>"Good exercise, good to feel the muscles working"</li> <li>"I love using my body for gentle exercise and this was an excellent class to do so"</li> </ul>
SORE/STIFF	<ul style="list-style-type: none"> <li>"I had a slightly sore right shoulder after one session"</li> <li>"One day was followed by a small amount of muscle stiffness but I had been holding my arms with a lot of tension"</li> </ul>
TIRED	<ul style="list-style-type: none"> <li>"At first my arms were tired after the 2nd session. But this went away with further sessions"</li> <li>"Legs and sometimes back tired"</li> </ul>

# cognitive

LEARNING A NEW SKILL	<ul style="list-style-type: none"> <li>"Learning something new at this stage - age ie - has been a very good experience for me"</li> <li>"Feel pleased to tackle something new and learn new skills"</li> </ul>
FOCUS & CONCENTRATION	<ul style="list-style-type: none"> <li>"Improved concentration"</li> <li>"Focusing better"</li> </ul>
OTHER <small>(multi-tasking, confidence in brain, memory, cleared headspace)</small>	<ul style="list-style-type: none"> <li>"I feel that my memory has improved and possibly multitasking as well"</li> <li>"Very beneficial left and right brain practice"</li> </ul>
BRAIN/BODY CONNECTION	<ul style="list-style-type: none"> <li>"It is a connective experience of brain and body to coordinate which is beneficial"</li> <li>"Must surely be good for my brain with the split time movements and crossing the midline"</li> </ul>
CHALLENGE	<ul style="list-style-type: none"> <li>"Enjoyed the challenge"</li> <li>"It was challenging and I did feel myself improving in some moves which I thought I'd never ever be able to do"</li> </ul>
ALERTNESS	<ul style="list-style-type: none"> <li>"Brain was more alert for a few hours afterwards"</li> <li>"I certainly feel more alert and confident in my brain power"</li> </ul>

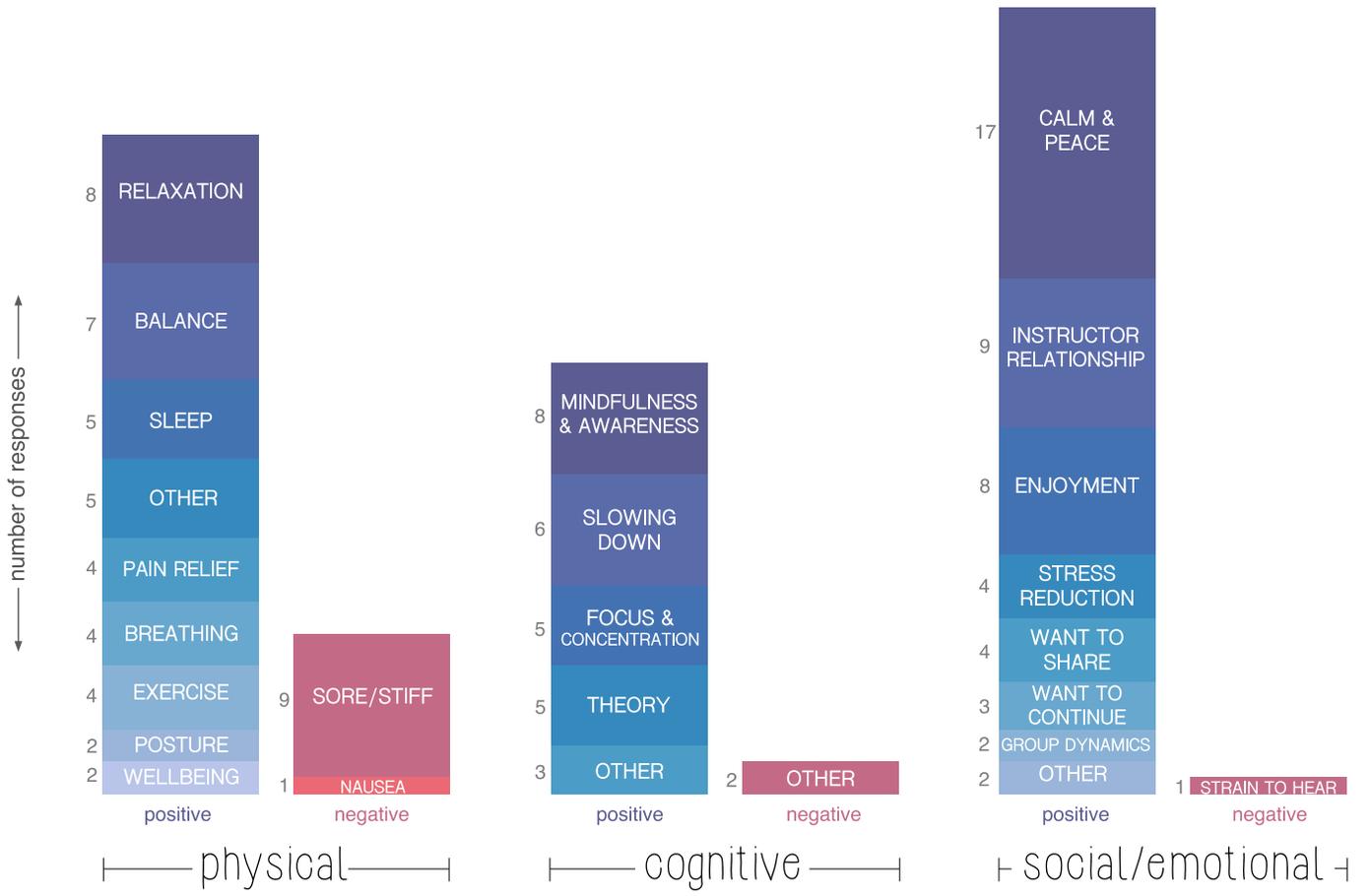
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# social/emotional

FUN & ENJOYMENT	“Very fun and enjoyable” “I get a sense of enjoyment from swinging my poi”
INSTRUCTOR RELATIONSHIP	“Working with Kate has been a joy” “Kate is a great leader, her passion for poi is infectious”
WANT TO CONTINUE	“I appreciate the opportunity to learn poi and will continue to practice when the classes have finished” “I’d very much like to keep going”
ACHIEVEMENT	“Felt sense of achievement” “I have a sense of accomplishment”
GROUP DYNAMICS	“Have enjoyed being part of the group” “Knowing that we are all similar in our way of thinking about aging”
CALM & PEACE	“There is quite an element of peacefulness about the experience of doing poi in synch” “Almost like a meditation”
FRUSTRATION	“A sense of frustration of not being able to master something new which looked to simple” “Had a lot of frustration when I realized my incompetence using the left hand”
OTHER (stressed, annoyed, worried)	“A little bit of stress trying to get it right, but a sense of joy when achieved” “Felt very uncoordinated and worried whether that would pass - it did”

Figure 11. Q3 question 2 - 4, International Poi data visualization

# Tai Chi



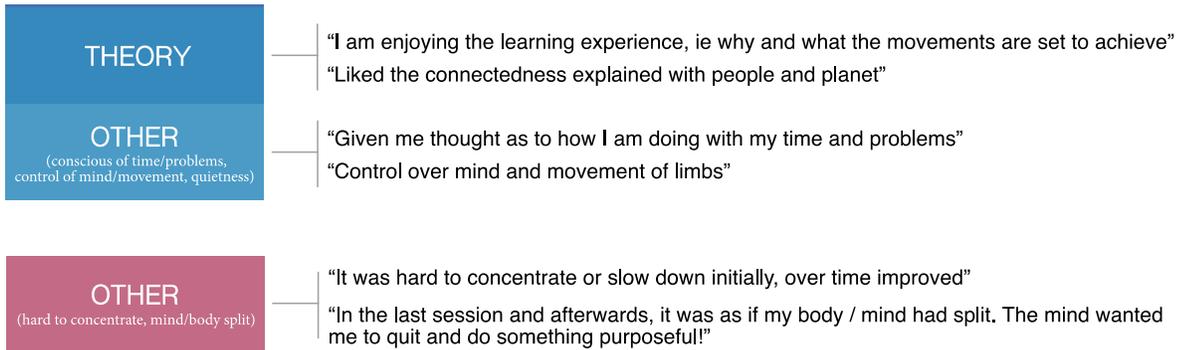
# physical

RELAXATION	“Always felt relaxed after it no matter what, even though stressors may have occurred before it” “I feel really relaxed and pleasantly stimulated after each session”
BALANCE	“My balance is improving” “I have definitely improved my ability to balance on one leg!”
SLEEP	“Sleeping much better - I used to wake often during the night. Wake feeling fresher.” “After 10 minutes Tai Chi before bed, I sleep better - getting off to sleep is easier”
OTHER (digestion, stronger core, lightness)	“My digestion has improved” “Flexibility better. There’s a gradual loosening of joints, etc.”
PAIN RELIEF	“I usually arrive with a very stiff neck, after Tai Chi it is gone and the relief lasts all day” “Fewer Aches and pains in joints - almost none”
BREATHING	“Calmed respiratory discomfort, surprisingly, while doing exercises” “More aware of breathing”
EXERCISE	“This experience has motivated me to exercise more in general” “I am currently on a diet and this exercise regime and my rowing really helps”
POSTURE	“Posture is improved - more aware of posture especially leaving class” “More aware of posture”
WELLBEING	“General sense of wellbeing” “A good insight to general well-being”
SORE/STIFF	“A little joint and muscle soreness but nothing worrying” “My arms felt a bit stiff sometimes but not too bad”
NAUSEA	“Sometimes felt nauseous by the time we had finished”

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# cognitive

MINDFULNESS & AWARENESS	“Experiencing more mindfulness and keeping calmer in awkward situations” “We can learn to still our minds and learn to act deliberately”
SLOWING DOWN	“Slowing down more frequently. Small gear change in thinking” “More aware of slowing down my reactions, ie ‘letting go’”
FOCUS & CONCENTRATION	“I concentrate better” “Much calmer and more focused”



## social/emotional

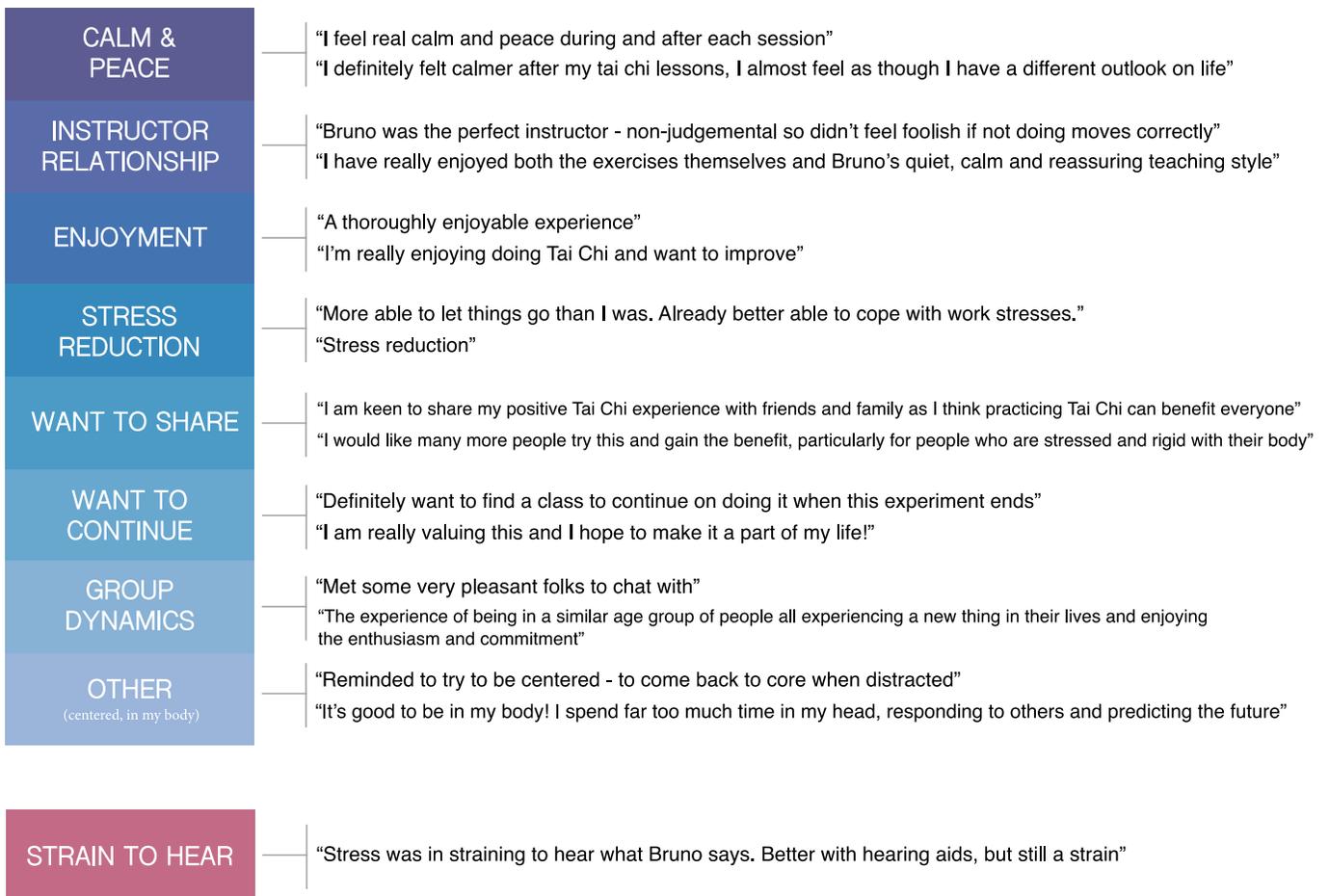


Figure 12. Q3 question 2 - 4, Tai Chi data visualization

### 4.3.4 Q4

Q4 was administered one month post intervention.

**Q4, question 1.** Have you practiced poi/Tai Chi since completing your lessons in the study?

	Yes	No
Poi	20	16
Tai Chi	26	17

**Q4, question 2.** Would you like to continue your poi/Tai Chi practice in the future?

	Yes	No
Poi	27	9
Tai Chi	32	7

*Table 11. Q4 responses*

## 4.4 Summary

Immediately post intervention the International Poi and Tai Chi group improved postural stability, upper limb strength, and simple attention. Tai Chi also improved systolic blood pressure. Composite memory and visual memory declined for both groups. One month post intervention both groups improved upper limb strength, upper limb range of motion, and memory (composite, visual, and verbal). Poi also improved systolic blood pressure. Questionnaire results showed both groups felt primarily relaxed during the intervention, with the Tai Chi group feeling more calm and peaceful, and the poi group feeling more challenged and happy. Both groups experienced more positive outcomes than negative, and wanted to continue their poi or Tai Chi practice. Therefore, both International Poi and Tai Chi may be useful for addressing quality of life in old age.

# 5. Discussion

## 5.1 Chapter overview

The purpose of this chapter is to discuss the findings and methodology of the present study. In regard to findings, this chapter will detail the clinical study and questionnaire results, compare and contrast the two, and discuss potential limitations. In regard to methodology, this chapter will discuss the teaching and learning framework, differences between rounds, and methodological limitations.

## 5.2 Findings

### 5.2.1 Clinical study

The following section will discuss the importance of the clinical study results alongside relevant literature, as well as discuss potential limitations. As the first of its kind, the mechanisms underlying the effects of poi on some aspects of function and not others need to be considered by future work.

#### 5.2.1.1 Baseline and test practice effects

Between T0 (one month prior to intervention) and T1 (immediately prior to intervention) the following measures improved for both groups: 30 Second Chair Stand, critical frequency for bimanual coordination, elbow range of motion, cognitive flexibility, complex attention, executive function, psychomotor speed, motor speed, and reaction time. This section will discuss these results along with issues regarding practice effects.

Practice effects are an increase in a participant's test score from one administration to the next, in the absence of any intervention (Bartels et al., 2010). Improved scores may be due to a multitude of factors, such as reduced anxiety over taking the tests, growing familiarity with the test taking environment and process, recall effects, and procedural learning. Practice effects also seem to be influenced by the characteristics of the test taker, the complexity of the test, and the amount of time between test sessions (Bartels et al., 2010). In the present study, two test sessions (T0 and T1) were held before the intervention, one month apart. This dual baseline assessment is one approach for reducing practice effects, as the second administration of the tests is typically more stable and can be used as a baseline for subsequent assessments (McCaffrey & Westervelt, 1995). However, this design presents some challenges. It could be that measures that showed practice effects at T1 were no longer susceptible to further practice effects at T2 or T3. It could also be that measures that showed no practice effects at T1, might show a practice effect at T2 or T3. However, this is unlikely as practice effects are typically more prominent on the second attempt than latter attempts, and many measures which did not improve at baseline also did not improve during the intervention. A more robust study design might include a third baseline measure to better capture practice effects, or a third non-active control group to check for practice effects of the assessment over all the assessment time points, but this was precluded by limited time and resources. Thus, the dual baseline approach was taken, and any measure which improved between T0 and T1 was not considered stable and was not readily interpreted moving forward.

When considering the measures which improved between T0 and T1, practice effects for the cognitive tests are plausible. Participants often found the cognitive test instructions confusing, and during the first test session the PI observed many participants began a test before they understood

exactly what they were meant to do, or question what they were meant to be doing during the middle of a test. If a test was considered invalid by the CNS Vital Signs scoring algorithm, it was immediately redone upon completing the battery. This helped eliminate scores which did not reflect the participant's best effort, however, the PI observed many occasions during the first test session in which the participant expressed concern or confusion during a test and the score was still considered valid by the CNS Vital Signs algorithm. The PI observed considerably less confusion in subsequent test sessions due to familiarity with the tests and recall from the previous assessment. Assessors also improved their ability to explain the instructions and answer common questions between T0 and T1. With all of this in mind, improvement in cognitive flexibility, complex attention, executive function, psychomotor speed, motor speed, and reaction time between T0 and T1 was not surprising. It was likely that a similar situation occurred with the bimanual coordination circle tracing task, as it was an unusual task and it could take a few tries to not only understand the instructions but get a feel for what was required (tracing circles simultaneously with both hands in time to a quickening auditory cue). Improvements in the 30 Second Chair Stand Test were likely due to inconsistencies with the chair itself, which are described in the Differences Between Rounds section of this chapter.

The remaining measure that was not stable at baseline, elbow range of motion, was a bit of an anomaly. It could be assumed this improvement was not due to the effects of practice, as the test simply involved folding the arm at the elbow. The tool used to measure elbow ROM, a standard universal goniometer, has well established reliability and is a widely accepted method of measuring ROM (Mullaney, McHugh, Johnson, & Tyler, 2010). One viable explanation was assessor error in measuring. When comparing data from T0 and T1, the PI observed some goniometry measurements which were considerably different for the same participant across time points. Some of these measurements had been taken by different assessors at different time points. In order to address

this, a special goniometry session was held to establish standard practices, as described in Chapter 3. That being said, assessor error may still have accounted for the improvement between T0 and T1, though it is curious why elbow ROM showed improvement and shoulder and wrist ROM remained stable, as all three were measured in the same fashion.

#### 5.2.1.2 Immediately post intervention

After one month of poi or Tai Chi lessons both groups improved their balance, hand grip strength, and simple attention. The Tai Chi group also dropped their systolic blood pressure. In addition, both groups composite memory and visual memory worsened. These results are discussed in detail below.

Both tests for balance (4-Stage Balance Test and Functional Reach) improved between T1 and T2, with no effect of group. Maintaining balance in old age is of utmost concern, as falls and fear of falling are major health problems for older adults. In the United States, one in three community dwelling adults aged 65 or older falls at least once a year; at least twice a year for those aged over 80 (Chang et al., 2004). Fall related injuries may lead to a loss of independence through disability and fear of falling (Chang et al., 2004). Improved balance in the present study is consistent with Tai Chi literature, which has shown that Tai Chi is a means to improve balance and reduce falls for healthy older adults (Chiang et al., 2009; Gregory & Watson, 2009; Hackney et al., 2013; Huang & Liu, 2015; Komagata & Newton, 2003; Liu & Frank, 2010; Low et al., 2009; Maciaszek & Osinski, 2010; Schleicher & Wedam, 2012; Wu, 2016). It is important that the results of the present study are consistent with Tai Chi literature, as it shows that the means of measuring were sensitive to the expected effects, and that the Tai Chi intervention produced the expected effects. As there were no effects of group, the poi group improved balance to a similar extent as the Tai Chi group. We can speculate that improvements in

balance are plausible for the poi group, as many moves involved crossing the midline and quickly turning or pivoting while controlling the poi. It should be noted that data from the 4-Stage Balance Test were only available for half the sample, as this test was only administered in round 2 of the study.

Hand grip strength improved between T1 and T2 with no effect of group. Hand strength is an important predictor of bone mineral density, likelihood of falls and fracture in osteoporosis, complications and general morbidity after surgery, general disability and future outcome, economic consequences of diseases, as well as cause specific and overall mortality in older adults (Angst et al., 2010). Grip strength is one of the strongest predictors of the consequences of Arteriosclerosis, one of the most frequent causes of morbidity and mortality (Angst et al., 2010). Literature on the effects of Tai Chi on hand grip strength, in healthy older adults specifically, is of mixed results. Some literature supports improvement in hand grip strength for healthy older adults (Frye et al., 2007; Rogers et al., 2009) while some is inconclusive (Woo, Hong, Lau, & Lynn, 2007). There is a similar mix of results regarding hand grip strength and Tai Chi for other populations. For example, a review of literature on Tai Chi as a treatment for rheumatoid arthritis found no improvement in hand grip strength (Han et al., 2004). Another study on Tai Chi as an exercise program for adults living in long-term care facilities found significant improvement in hand grip strength (Chen et al., 2008). This thesis supports and adds to the literature on Tai Chi as a means to improve hand grip strength for healthy older adults, though further research in this area is warranted. Hand grip strength seems more integral to poi than it does to Tai Chi, as practicing poi involves physically holding something. Thus, it is not surprising to see improvements in hand grip for the poi group. When practicing Tai Chi the hands are exercised, but they are not physically acting against anything, making grip strength more of a mental construct. Perhaps this is why literature on Tai Chi and grip strength is inconsistent.

Simple attention, or sustained attention, improved between T1 and T2 with no effect of group.

Sustained attention refers to the ability to maintain or focus attention over a period of time (Huntley et al., 2017). Literature on the effects of Tai Chi on attention, in healthy older adults specifically, is of mixed results. One review found tests of attention showed significant improvements in some studies and not others, with no explanatory patterns (Miller & Taylor-Piliae, 2004). Another posited there is potential for Tai Chi to enhance executive function, but further rigorous research is needed (Wayne et al., 2014). This thesis supports and adds to the literature on Tai Chi as a means to improve attention for healthy older adults, though further research is warranted. When considering the poi group, an improvement in attention is not surprising. Learning poi requires intense focus and concentration. If focus is lost, the poi will often collide and tangle with each other, or hit the person wielding them. Though both Tai Chi and poi require attention, there are more tangible ramifications for losing focus during poi practice. It should be noted that data for simple attention were only available for half the sample, as the Continuous Performance Test (CPT) for simple attention was only administered in round 2 of the study. Simple attention was one of two variables in the attention domain, the other being complex attention (measured with the Stroop Test, Shifting Attention Test, and CPT). Complex attention was not stable at baseline.

Visual memory (recognition for symbols or shapes) and composite memory (the combined score from CNS Vital Signs for visual memory and verbal memory) declined between T1 and T2 for both groups. A large and well-developed body of research regarding memory and ageing concurs that the ability to remember certain types of information declines with age, even in healthy individuals (Buckner, 2004; Crook et al., 1986). Considering the study sample was 60 – 86 years old, mean age 69.1, a decline in

memory is consistent with the aforementioned research. However, it is surprising to see this decline in such a short period of time.

Systolic blood pressure dropped for the Tai Chi group only. Hypertension, or high blood pressure, is estimated to cause 4.5% of the global disease burden (World Health Organization, 2003). Reducing systolic blood pressure is linked to reductions in stroke, myocardial infarction, heart failure, kidney failure, and overall cardiovascular disease morbidity and mortality (Izzo, Levy, & Black, 2000). The drop in systolic blood pressure for the Tai Chi group is consistent with previous research on Tai Chi and cardio-respiratory function (Chiang et al., 2009; Rogers et al., 2009; Zheng et al., 2015), though further rigorous research in this area is needed. When considering the nature of poi and Tai Chi, it is not surprising that blood pressure dropped for the Tai Chi group only. Tai Chi involves slow flowing movements with a focus on breathing, whereas poi involves faster paced movements and the added difficulty of controlling an orbiting weight. In addition, the Tai Chi lessons were quite easy to follow from the beginning as participants could mirror the instructor, while the poi lessons presented more of a challenge, and possibly more stress. This is further discussed in the questionnaire results section later in this chapter.

Finally, practicing poi involves wrist flexibility and strength along with coordination and controlling both hands independently, thus improvements in wrist ROM and bimanual coordination may be expected, but were not seen. For wrist ROM we can speculate that perhaps the goniometry was not up to par, as discussed previously in this section in regard to elbow ROM. For bimanual coordination it is possible that the means of measuring (determining the critical frequency manually by watching a video recording of the circle tracing task) were not sensitive to the expected effects. Originally the circle tracing task was to be done on a digital tablet, in which case the critical frequency could have

been pin-pointed in the data. However, this was precluded by limited time and resources. In general, it is difficult to discern if poi's unique characteristics, such as rhythmic object manipulation, had a specific effect on outcomes.

### 5.2.1.3 One month post intervention and activity practice effects

One month after the intervention both groups improved their hand grip strength, shoulder ROM, and memory (composite, visual, and verbal). The poi group also dropped their systolic blood pressure. To follow is a discussion of these results and the continuation of poi and Tai Chi post intervention.

Participants were given no instruction in regard to practicing poi or Tai Chi outside of the study, either during or post intervention. During the intervention no record was kept of participant activity outside of the study. This is a limitation of the present study, and would be useful to include in future research. One month post intervention participants were given Questionnaire 4 (Q4), which asked if they had continued their poi or Tai Chi practice. Results of Q4 show that 25 participants had continued their Tai Chi practice, and 17 had not. For International Poi, 20 participants had continued their practice, and 16 had not. The degree of practice varied from "daily" to "very little."

Questionnaire 4 was not coded, so it is impossible to draw relationships between continuation of poi or Tai Chi and outcomes at T3. In other words, there is no way to tell if the improvements seen one month post intervention are due to continued poi and Tai Chi practice. Thus, these results will not be further discussed. A suggestion for future research is to code all questionnaires so they can be linked to clinical study data, and include a third group for which no benefits were predicted in order to detect practice effects.

#### 5.2.1.4 Extended intervention in round 2

Participants in round 2 took part in a two month intervention, as opposed to the one month intervention in round 1. The reason for this extension was to address the potential criticism of the intervention being relatively short in comparison to other research studies with similar interventions. Participants in round 2 were assessed at the one month mark (which aligns with participants in round 1) but they were also assessed at the two month mark. When comparing baseline measurements to the two month mark, significant main effects of time were seen in the 30 Second Chair Stand Test, complex attention, cognitive flexibility, executive function, psychomotor speed, and motor speed. However, these results were not readily interpreted, as they were not stable at baseline. A significant main effect of time was seen in the Emotional Well Being domain of the SF-36 ( $P = 0.011$ ). This is the only significant result at this time point which was stable at baseline. However, there were only 13 participants in the poi group, and 22 participants in the Tai Chi group, available for analysis at the two month mark. This sample is simply too small to draw any meaningful conclusions.

#### 5.2.1.5 Limitations

As discussed above, a major limitation of this study is the lack of a control group for which no benefits were predicted. This additional control group would allow us to check for practice effects of the assessments over all four assessment time points. Another limitation discussed above is the inability to draw relationships between continuation of poi or Tai Chi after the intervention and outcomes at T3, as the questionnaire regarding continued poi or Tai Chi practice was not coded. In addition to these limitations, a larger sample size and longer intervention period may have increased the study's sensitivity to differences in the effects of the two interventions. Finally, participants' awareness of taking part in an intervention may have positively influenced results, as thoroughly discussed and

debated in literature on the placebo effect, Hawthorne effect, Pygmalion effect, etc. (Draper, 2000). More specifically, any intervention that gave participants individual attention in a small group setting, provided a peer group, and/or got them up and moving, may have produced similar outcomes. Results from Questionnaire 4 show that the majority of participants were vigorously or moderately active prior to beginning the study (see Chapter 4). While this helps allay the concern that any marked increase in physical activity would produce benefits, self-reported exercise levels may be inaccurate, and all of the aforementioned concerns are limitations which should be acknowledged and addressed in future research.

#### 5.2.1.6 Summary

International Poi seems to be as effective as Tai Chi at improving physical and cognitive function in healthy older adults. Immediately post intervention both groups improved in balance, hand grip strength, and simple attention. Tai Chi also improved systolic blood pressure. Improvements in balance and blood pressure for the Tai Chi group are consistent with Tai Chi literature, though further rigorous research on Tai Chi is called for. One month post intervention both groups improved hand grip strength, shoulder ROM, and memory (composite, visual, and verbal). The poi group also dropped their systolic blood pressure. However, it is impossible to draw relationships between these results and the continuation of poi or Tai Chi post intervention. A major limitation of the present study is the lack of a control group for which no benefits were predicted, which was partially addressed by examining practice effects with two baseline assessments.

## 5.2.2 Follow-up questionnaires

The overarching purpose of the questionnaires was to systematically augment the clinical study data. This may provide the researcher with greater explanatory power, shed light on data trends, and illuminate qualities which set International Poi apart from Tai Chi. It should be noted that all questionnaire data were gathered anonymously and were not coded, so there is no way to link participants' questionnaire data with their clinical study data, or track individual participant responses throughout the study. As detailed in Chapter 3, the following discussion is based on a constructivist epistemology. The researcher's past experiences with and current perspectives toward poi are inextricably intertwined with her interpretations of the qualitative data and indeed lend additional credence to them (Eisner, 1998). As Linda Finlay (2002) states:

Our behavior will always affect participants' responses, thereby influencing the direction of findings. Meanings are seen to be negotiated between researcher and researched within a particular social context so that another researcher in a different relationship will unfold a different story. (p. 531)

### 5.2.2.1 Q1

The purpose of Questionnaire 1 was to assess participants' level of exercise prior to beginning the study. By collecting this data we can determine the overall exercise level of each group, and better understand if physical improvements seen in the present study were due to the specific interventions, or due to increased physical activity in general. It should be acknowledged that self-reported exercise levels may be inaccurate (Prince et al., 2008). Responses to "Prior to beginning this study, how physically active were you?" are as follows.

	Vigorously active	Moderately active	Seldom active
Poi	5	10	2
Tai Chi	4	16	3

The majority of participants reported being moderately active prior to the intervention. The intensity level of an activity is determined using metabolic equivalents of task (METs), or the energy cost to the individual (Ainsworth et al., 2011). Light intensity activities (<3 METs) require the least amount of effort, compared to moderate and vigorous activities, and include things like leisurely walking or light housework (Bann et al., 2015). Moderate intensity activities increase breathing and heart rate to some extent, and include things like brisk walking, dancing, or bicycling on level terrain (“Physical Activity Guidelines”, 2008). On a scale of 0 to 10 (relative to a person’s capacity), a moderate intensity activity would be a 5 or 6 (“Physical Activity Guidelines”, 2008). Tai Chi is considered a light to moderate form of exercise, depending on the style and duration (Lan et al., 2013). There is no literature on the activity level of International Poi, but considering the type of movement and the definition above, poi could be considered a light to moderate form of exercise as well, depending on the style and duration. Therefore, taking part in the present study did not represent an increase in activity level for most participants. This helps allay the concern that any marked increase in physical activity would produce benefits. We can also see that the poi group and Tai Chi group were relatively similar in overall exercise levels.

#### 5.2.2.2 Q2

The purpose of Q2 was to capture participants’ reactions to the intervention. Participants were asked to use three words to best describe how they felt after each lesson. Below are the top ten responses, for each group. The numbers represent how many times a word was written. The poi group has two extra words at the bottom of the list, as there was a four way tie for the last word.

International Poi	Tai Chi
52 relaxed	117 relaxed
30 challenged	112 calm

29	happy	38	peaceful
26	better	26	energised
26	enjoying	18	focused
24	fun	17	slow
20	frustrated	16	happy
20	tired	16	warm
18	good	14	aware
18	progress	14	tired
18	improving		
18	uncoordinated		

*Table 12. Q4 top 10 responses by group*

Overall, we can see that both groups felt primarily relaxed. This is an interesting finding, as the atmosphere of the poi and Tai Chi lessons was quite different. During the Tai Chi lessons participants stood in rows facing the instructor, who stayed at the front of the room. The same music, a compilation of songs for meditation, Tai Chi, yoga, relaxation, etc., was played each lesson. Movements were carried out in silence, other than the occasional comment from the instructor to breath in or out, shift left or right, etc. In general, the atmosphere was very calming. For the poi lessons, participants stood in various configurations from lines to a circle facing each other to randomly spread out. A wide variety of upbeat music was played, including New Orleans brass, Nigerian jùjú, and funk. Sometimes the room was relatively quiet as participants focused, but more often than not participants were chatting to each other or the instructor, making comments to themselves out loud, or laughing in frustration or accomplishment. The instructor also spoke a considerable amount in order to explain moves. She also moved to and fro, often helping individual participants. In general, the atmosphere was lively. Considering the difference in atmosphere, it is interesting that the poi group felt primary relaxed according to the word cloud data. One possible explanation is that even though the atmosphere of the poi lessons was quite upbeat and the movements were often challenging, the fundamental act of swinging the poi was calming. As one poi

participant noted: “Even though I am concentrating on what I am trying to achieve with each move, I find it quite relaxing.” Another stated “Relaxed and fun environment.” Another contributing factor may have been the cool down exercises at the end of each poi lesson, which were intended to relax participants (physically and mentally) after the challenge of practicing poi. The exercises involved gentle stretching and incorporated some elements of Tai Chi, such as focused breathing and some similar postures. Seeing as participants answered the word cloud question at the end of each lesson, it is likely that the cool down exercises influenced responses.

When we examine the second and third word on the list for each group, some differences between poi and Tai Chi arise. The Tai Chi group felt calm and peaceful, while the poi group felt challenged and happy. This brings some important differences between poi and Tai Chi to the forefront. The top three word cloud responses from the Tai Chi group, “relaxed”, “calm”, and “peaceful”, reflect the literature on Tai Chi and the nature of the activity in general. Tai Chi has been described as a moving meditation with slow, flowing, continuous postures and a focus on deep breathing Tai (Horowitz, 2011). It has been proven to decrease depression, stress and anxiety in a myriad of populations (Field, 2011; Rogers et al., 2009). The aspect of calm and peace is not reflected in the responses from the poi group, and is thus an important difference between the two activities.

The top three word cloud responses from the poi group, “relaxed”, “challenged”, and “happy”, suggest that poi is fun, and that it may present some challenges which Tai Chi does not. Regarding the response “happy”, we can see that five out of the top ten words for the poi group relate to having a positive emotional experience: happy, better, enjoying, fun, good. It is believed that Māori Poi was considered a form of play from the very early stages of its existence (Paringatai, 2004). Poi continues to be considered a form of play today, in both Māori and International contexts, meaning it is done

for its own sake, arising out of innate motivations (Brown, 2009). The aspect of play is not reflected as prominently in the Tai Chi group, and is thus an important difference between the two activities.

Regarding the response “challenge”, we can see that five out of the top ten words for the poi group relate to being challenged: challenged, frustrated, progress, improving, uncoordinated. This suggests that learning poi involves some tasks which were not easily accomplished. The aspect of challenge is not reflected in the Tai Chi group, and is thus also an important difference between the two activities. The level of challenge in each activity is discussed at length in the next section of this chapter, which examines responses to a question about progress learning each activity.

One additional trend to note is that the majority of responses from the Tai Chi group fall into the category of relaxed (117 responses) and calm (112 responses). The next word on the list drops down to only 38 responses. Responses from the poi group are more varied. The most said word for the poi group only weighs in at 52 responses, with subsequent words coming in at 30, 29, 26, 26, 24, etc. The variety of poi group responses, in comparison to the more homogenous Tai Chi responses, may provide further insight into potential differences in the activities. As discussed above, and again later in this chapter, the poi lessons were less structured, more participant directed, and potentially more challenging than the Tai Chi lessons. The wider variation in poi word cloud responses may be a reflection of this. Greater autonomy may lead to a more unique experience, and thus a wider variation in feelings and experiences. This is not to say that Tai Chi generally produces homogenous experiences, but rather in the present study with novice poi and Tai Chi students, the experience of the Tai Chi group may have been more homogenous than that of the poi group.

If we divide the word clouds by round, we can gain insights about the experience of participants in round 1 of the study versus round 2. Below are the top ten responses for each group in each round.

The numbers represent how many times a word was written. In the case of multiple words being tied for the last spot, all the words are included.

International Poi	
Round 1	Round 2
18 improving	39 relaxed
15 challenged	18 happy
13 enjoying	13 challenged
12 uncoordinated	13 enjoying
12 relaxed	12 fun
11 happy	11 tired
11 fun	10 frustrated
10 frustrated	9 exercised
9 progress	9 good
9 tired	8 progress
9 good	
Tai Chi	
Round 1	Round 2
52 calm	69 relaxed
48 relaxed	60 calm
16 focused	23 peaceful
15 peaceful	13 energised
13 energised	10 happy
7 better balance	10 warm
7 slower	10 slower
6 aware	9 inspired
6 happy	8 tired
6 tired	8 aware
6 warm	
6 good	

Table 13. Q4 top 10 responses by group and round

In general, the top ten responses between the two rounds for each group were relatively similar. This reflects consistency between rounds, which was a goal of the present study. When looking at each group there are a few unique words in each round. For the poi group, “improving” and “uncoordinated” are only in round 1, and “exercised” is only in round 2. For the Tai Chi group,

“focused”, “better balance”, and “good” are only in round 1, and “inspired” is only in round 2. Some differences between rounds are expected, as each participant had their own unique experience and feedback. The differences are not substantial enough to imply any major differences between rounds.

### 5.2.2.3 Q3

The rationale behind Q3 was to gather data on participants’ perceived effects, positive and/or negative, of the intervention. These data may illuminate any underlying bias of participants’ psychological states, which may have affected the clinical study outcomes. It also gives us a broader understanding of the potential impact of the intervention. Q3 was administered immediately after the intervention. The first question on Q3 was: Reflecting on the past month, how much progress do you feel you made learning poi/Tai Chi? Responses are as follows:

	Little progress	Some progress	Lots of progress
Poi	0	11	23
Tai Chi	1	28	12

As seen in the responses, the poi group felt they made more progress than the Tai Chi group. This could be related to the nature of each activity and the balance between challenges and skills as discussed by Csikszentmihalyi in regard to flow (Csikszentmihalyi, 1996). Practicing poi involves manipulating an external object. In order to keep the poi from crashing into each other or into one’s body, the participant must fine tune their movements. While participants can mimic the instructor to a degree, they must understand the mechanics of the movement themselves and be able to execute the movement with relative accuracy in order to avoid collisions. When learning Tai Chi, participants also aimed to master certain movements, but because there was no external object orbiting around there was more leeway for error. For example when practicing the Tai Chi movement cloud hands, participants could move their arm the wrong direction with no major consequence. In fact one could

not even be aware that their movement does not match the instructor's. On the other hand, while practicing the poi move figure 8, an arm going the wrong direction will most certainly bring the movement to a crashing stop.

This difference between poi and Tai Chi relates back to Csikszentmihalyi's thoughts on the quality of subjective experience. Csikszentmihalyi believes that one's experiences are made up of two subjective variables: the perceived challenge of an activity, and the perceived skill necessary to meet that challenge. If the challenge and the skill are low, then the quality of one's experience is low. If the perceived challenge is too high, then one may feel anxious. If the perceived challenge is too low, then one may feel bored. But if the challenge and the skill are simultaneously perceived to be high, then the overall experience is high (Csikszentmihalyi, 1990). When thinking about the level of challenge for poi and Tai Chi as discussed above in relation to Csikszentmihalyi's theory of flow and the balance between challenges and skills, it is plausible that the poi group felt they made more progress than the Tai Chi group. By being presented with a higher level of challenge and skill, the poi group likely felt a greater sense of progress and accomplishment. This is also reflected in the aforementioned word cloud data, in which "challenged" was the 2<sup>nd</sup> most said word in the poi group, and "progress" was the 10<sup>th</sup>. For the Tai Chi group, "challenged" came in 26<sup>th</sup> on the list and "progress" was not mentioned at all.

Question 2, 3, and 4 were open ended questions. Questions 2 and 3 asked if the participant felt any positive or negative effects from the intervention. Question 4 asked if there was anything else the participant would like to share. Data from these questions were grouped into three overarching categories (physical, cognitive, emotional), as these directly reflect the categories for the clinical study data. Data were then chunked/grouped into sub categories to examine trends and common themes

(Creswell, 2003; Creswell et al., 2007, Miles & Huberman, 1994). For both groups, the vast majority of answers fell into the positive effects category. Full responses to these questions can be seen in Appendix D.

For the Tai Chi group, “relaxation” was the top theme in the physical category. This directly reflects the word cloud data, of which the top response was “relaxed.” One participant noted “I always felt relaxed after [Tai Chi] no matter what, even though stressors may have occurred before it.” Another stated “I am more relaxed and more at peace.” For the cognitive category, “mindfulness and awareness” was the top theme. Mindfulness was not mentioned in the top 10 word cloud responses, though “focused” was the 5<sup>th</sup> most said word and “aware” was the 9<sup>th</sup>. Participants mentioned the effects of Tai Chi on the mind in various ways. For example: “I am experiencing more mindfulness and keeping calmer in awkward situations.” “Working the body and mind makes me more aware of negative thoughts outside of class.” “As with meditation, and lots of other things, we can learn to still our minds and learn to act deliberately.” For the emotional category, “calm and peace” was the top theme, and the most mentioned theme overall in the open ended questions. This directly reflects the word cloud data, of which the 2<sup>nd</sup> and 3<sup>rd</sup> most said words were “calm” and “peaceful.” Many participants mentioned calm and peace both within and outside of the Tai Chi lessons: “I feel real calm and peace during and after each session. Sometimes I can enter this space in my between session life, but not as much as I would like yet (there goes my yang!).” “I definitely feel calmer after my Tai Chi lessons, I almost feel as though I have a different outlook on life. I can tell when I and other people are stressed.” In general, the open ended questions directly reflect the word cloud data, and the themes of relaxation, calm, and peace dominated the responses in both. Regarding the negative effects of Tai Chi, there were a handful of responses relating to being sore or stiff. None of the responses mentioned any serious problems: “A little joint and muscle soreness but nothing worrying.”

“My arms felt a bit stiff sometimes but not too bad.” “Just a few twinges – I’m carrying injuries but they cope and so did I.”

For the poi group, “flexibility/looseness” was the top theme in the physical category. This is not reflected in the top 10 word cloud responses, though “stretched” and “loose” both appear lower down the word cloud list with 8 and 7 responses respectively. Participants primarily mentioned a flexibility or looseness in their wrists and shoulders: “Wrists have loosened up and shoulders have relaxed.” “I think it has been helpful for my arthritic wrists.” “More flexible in shoulders.” For the cognitive category, “learning a new skill” was the top theme. This is reflected in the word cloud data, with “challenged” being the 2<sup>nd</sup> most said word, and “progress” and “improving” tied for the 10<sup>th</sup> most said word. Many participants commented on the positivity associated with learning something new: “I felt good learning a new skill. It was challenging and I did feel myself improving in some moves which I thought I could never ever be able to do.” “Learning something new at this stage – ie age – has been a very good experience for me.” “I feel pleased to tackle something new and learn new skills.” For the emotional category, “fun/enjoyment” was the top theme, and the most mentioned theme overall in the open ended questions. This is directly reflected in the word cloud data, with “enjoying” as the 5<sup>th</sup> most said word, and “fun” as the 6<sup>th</sup>. Participants noted: “Very fun and enjoyable experience.” “Fun class so I leave feeling good.” “I find picking up my poi at home fun and relaxing. I get a sense of enjoyment from swinging my poi.” In general, the open ended questions reflect the word cloud data.

While the aforementioned findings may already be well known to poi practitioners, this is the first time scientific evidence has substantiated this knowledge. Regarding the negative effects of poi, there were a handful of responses relating to being sore or stiff. None of the responses mentioned

any serious problems, and most responses mentioned some initial discomfort which either dissipated with time or dissipated due to altering a movement: “Sore wrists after first class, then nothing after that.” “I have to be careful not to lift my arms too high as the arm movements can aggravate my shoulder problem.” “One day was followed by a small amount of muscle stiffness but I had been holding my arms with a lot of tension.”

#### 5.2.2.4 Q4

Questionnaire 4 gathered data on participants’ continued engagement with the intervention activity, outside of the present study. The results are summarized as follows:

**Q4, question 1.** Have you practiced poi/Tai Chi since completing your lessons in the study?

	Yes	No
Poi	20	16
Tai Chi	26	17

**Q4, question 2.** Would you like to continue your poi/Tai Chi practice in the future?

	Yes	No
Poi	27	9
Tai Chi	32	7

These results show that 55.5% of poi participants continued their practice, and 75% would like to continue. For Tai Chi, 60% continued their practice, and 82% would like to continue. Overall, both activities are generally desirable (the majority of participants did continue or would like to continue the activity). This is an important discovery, as if an activity is not desirable or enjoyed, it is less likely to be practiced. For future research it would be useful to ask more specific follow-up questions in order to better understand why some participants continued their practice and others did not.

### 5.2.2.5 Limitations

There were a number of limitations with the questionnaires. First, the type of data gathered was limited by time (both the participant's time and the researcher's time). A second limitation was not coding the questionnaires, which meant participants clinical study and questionnaire data could not be linked, and individual participant responses could not be tracked throughout the study. However, exploring the data in this way would require a considerable amount of time and was not a primary goal of the study. Overall trends in the data, which can be seen without coding, were prioritized over tracking data from individual participants. The final limitation was money. If given a budget to hire additional staff or better compensate participants, for example, perhaps some of the aforementioned methods could have been utilized. However, a limited budget precluded this possibility.

### 5.2.2.6 Summary

The questionnaire data show that the International Poi and Tai Chi group felt primarily relaxed during the intervention, with the poi group feeling more challenged and happy, and the Tai Chi group feeling more calm and peaceful. The data reveal a few differences between the activities, such as the possibility that Tai Chi may produce a calmness and mindfulness that poi does not, and that poi may produce a sense of fun and challenge which Tai Chi does not. The poi group felt they made more progress learning their activity, possibly because the level of challenge presented by poi may result in a greater sense of progress. The majority of participants in both groups reported wanting to continue their practice, suggesting that both activities are enjoyable--an important quality for an intervention.

## 5.2.3 Clinical study and questionnaire comparison

The following section will compare the clinical study results from immediately post intervention to the data generated by the follow-up questionnaires. It will not investigate the trial results from one month post intervention, as it is unclear whether results at this time point were due to continued practice of the intervention activity. The following section is organized by physical, cognitive, and emotional domains.

### 5.2.3.1 Physical

Immediately post intervention, balance and hand grip strength improved for both groups, and the Tai Chi group dropped their blood pressure. When considering the poi group, the top responses to Q3 (Did you experience any positive or negative effects from the intervention?) in the physical domain were “flexibility/looseness” and “handedness.” The response of “handedness” directly supports the finding of hand grip strength. Participants primarily mentioned an awareness of their non-dominant hand, and improvements in strength and coordination. One participant stated, “I have gained strength and direction in my left hand and arm which I noticed when sawing through a heavy tree branch.” Another stated “Made me more aware of using my left hand, now try to do more with it like making a coffee, opening fridge door.” The response of “flexibility/looseness” is not reflected in the clinical study data. We might expect to see a statistically significant improvement in upper limb range of motion or manual dexterity, as participants primarily mentioned flexibility/looseness in relation to the upper limb. This was not seen immediately post intervention, though one month post intervention there was a significant improvement in upper limb range of motion. However, data from one month post intervention will not be further discussed, as there is no way to tell if improvements were due to continued poi practice. Other than one comment (“I think spinning poi is improving my

peripheral vision and balance”) the poi group did not mention balance, the other statistically significant result. While it is plausible that practicing poi may improve balance, there is not a direct focus on balance as there is during Tai Chi practice. For example, Tai Chi participants practiced standing on one leg in various poses, consciously shifting their weight, etc. Poi participants were required to shift their weight while moving the poi across their midline, or when executing a half turn, but during these exercises the focus was on moving the poi, not balancing. In other words, balance is often in the foreground during Tai Chi practice, and the background during poi practice. This may explain why poi participants did not report improvements in balance.

When considering the Tai Chi group, the top responses to Q3 in the physical domain were “relaxation” and “balance.” The response of “relaxation” directly supports the finding of lowered blood pressure. Many participants commented on the relaxed, calm feelings produced during Tai Chi: “I feel really relaxed and pleasantly stimulated after each session.” “Always felt relaxed after it no matter what, even though stressors may have occurred before it.” The response of “balance” directly supports the findings of improved balance. Many participants reported their balance improving, or possibly improving. The Tai Chi group did not mention anything related to hand grip strength, the other significant clinical study finding. This is not surprising as Tai Chi does not particularly target or focus on grip strength. Future research with a larger sample size is recommended in order to detect effects of group and ensure replication of results.

In summary, the questionnaire data from the International Poi group reflects the improvement in grip strength and does not reflect the improvement in balance seen in the clinical study data. The questionnaire data from the Tai Chi group reflects the improvement in balance and blood pressure and does not reflect the improvement in grip strength seen in the clinical study data.

### 5.2.3.2 Cognitive

Immediately post intervention, there was an improvement in attention and a decline in memory for both groups. When considering the poi group, the top responses to Q3 in the cognitive domain were “learning a new skill” and “focus and concentration.” The response of “focus and concentration” directly supports the finding of improved attention. One participant said “[I am] learning to concentrate more. Focusing better.” Only two participants mentioned the other significant result, memory: “I feel that my memory has improved and possibly multitasking as well.” “I did a random memory test one day on an app and I got 1% top. I’m taking that as a positive (but obviously not scientifically proven).” This is in contradiction to the decline in memory seen in the clinical study data.

When considering the Tai Chi group, the top responses to Q3 in the cognitive domain were “mindfulness and awareness” and “slowing down.” These responses both support the finding of improved attention. One participant said “[I am] slowing movements (yin), concentration, and focus during exercise.” Another said, “Experiencing more mindfulness and keeping calmer in awkward situations.” It is plausible that feelings of improved attention and slowing down may positively impact the ability to sustain one’s attention, as was required in the cognitive test for simple attention. There was no mention of memory in the questionnaire data, the other significant result.

In summary, the questionnaire data from both the International Poi and Tai Chi group reflects the improvement in attention and does not reflect the decline in memory seen in the clinical study data.

### 5.2.3.3 Emotional

The 36-Item Short Form Survey (SF-36) was the only measure of emotional health, and it did not yield any statistically significant results immediately post intervention. This is inconsistent with the strong positive emotions expressed through the questionnaires. These positive emotions are illuminated in quotes throughout this section, and cover a wide variety of perceived physical, cognitive, and social/emotional benefits. One possible explanation is that the eight health concepts of the SF-36 (physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, emotional wellbeing, social functioning, energy/fatigue, and general health perceptions) are quite broad, and were not sensitive to the participants' experience. While other measures in the domain of emotional health were considered, the SF-36 was ultimately chosen based on the time necessary to execute the test, and how well the test might relate to the act of practicing International Poi. Measures of flow state and play may have better reflected emotional health in the present study, but these were less relevant to an ageing population in comparison to the other variables being considered, and ultimately not included (see Chapter 3). The SF-36 failing to yield statistically significant results sheds light on the importance of the questionnaire data, and the role it plays in painting a more well-rounded picture of the participants' experience and outcomes.

### 5.2.3.4 Summary

In summary, the questionnaire data from both the poi and Tai Chi group generally supports and reflects the clinical study results, however, there are some inconsistencies. The questionnaire data do not reflect an improvement in balance for the poi group, an improvement in grip strength for the Tai Chi group, or a decline in memory for both groups. In addition, the questionnaires show a myriad of positive experiences in the emotional domain, but no significant results in the emotional domain were

seen in the clinical study. These inconsistencies reiterate the importance of questionnaire data and its ability to paint a fuller picture alongside clinical study findings.

## 5.3 Reflection on methodology

A rigorous methodological groundwork was laid for the present study, as discussed in Chapter 3. The following section will discuss any changes or notable observations in regard to methodology. More specifically, it will first discuss some observations regarding the teaching and learning framework. Next, it will discuss differences between round 1 and round 2 of the clinical study, in order to provide complete transparency regarding the study execution. Last, it will discuss some methodological limitations.

### 5.3.1 Teaching and learning framework

This study follows the andragogical principles espoused by Malcolm Knowles (the learner is autonomous, free, and growth-oriented) and an active learning methodology, (learners are actively engaged by doing things and by thinking about the thing they are doing) (Knowles, 1980; Prince 2004). In addition, equal value was placed on the learner, the teacher, and the content (Lusted, 1986). Given this framework, the following section will discuss two notable differences between the poi and Tai Chi groups, and how this may have impacted the learning experience. This section will also explore the student teacher relationship as illuminated by the questionnaire data.

As discussed in Chapter 2, Tai Chi is much more than a series of movements, but rather a philosophy and a way of life which dates back to between the 12th and 14th centuries. Whilst Māori Poi also has deeper meaning embedded in cultural context, International Poi does not. This led to a considerable

difference in the International Poi and Tai Chi lessons, that is, an undercurrent (or lack thereof) of philosophy and cultural context. The majority of Tai Chi lessons began or concluded with a discussion facilitated by the instructor. These discussions covered a wide variety of topics within Tai Chi philosophy, such as natural methods to increase melatonin, alpha and beta brain waves, meridians, meditation, mindfulness, and how to activate the tendons. Handouts often accompanied the discussions, which are provided in Appendix C.

The International Poi lessons did not include discussion time, beyond informal discussions which spontaneously arose while practicing poi. The impact of the discussions in the Tai Chi group can be seen in the responses to Questionnaire 3, which asked participants if they experienced any positive or negative effects due to the intervention. For the Tai Chi group, “theory” arose as one of the categories, with participants commenting on a variety of things they learned through the discussions: “I am enjoying the learning experience, i.e. why and what the movements are set to achieve”, “Like the connectedness explained with people and the planet”, and “Interested in the theory.” While the poi group commented on enjoying learning a new skill, they did not comment on the meaning behind or philosophy behind poi, understandably. Because questionnaire data were not coded, there is no way to determine if discussions around Tai Chi philosophy had any impact on the performance of individual participants in the clinical study.

Another notable difference was participant autonomy. During each Tai Chi lesson, participants moved through the same series of postures with a focus on breathing and awareness. The first section of each Tai Chi lesson did sometimes include different variations of warm up exercises, and the exercises were not presented in an identical order each time. The Yang style Tai Chi Chuan 18 movements, however, were identical each lesson. The International Poi lessons, though following a general lesson

plan, were significantly less structured or precise. Which moves were taught during a lesson, and in what order, ebbed and flowed depending on participants' progress and feedback. New moves and variations of moves were introduced as lessons progressed. The instructor often suggested multiple paths within a move, and let participants decide what was best for them (for example, "If you are still working on the foundations, just stick with one hand. If you are feeling comfortable with the foundations, try two hands. If you are feeling comfortable with two hands, try split time.").

Participants were also given free time during each lesson. Thus, the International Poi lessons were more participant directed and less structured than the Tai Chi lessons. Any effect of this is not specifically reflected in the questionnaire responses, though it is possible that having greater autonomy lead to a greater sense of challenge, which is discussed in detail previously in this chapter.

It should be noted that, despite these differences, ground rules were laid to ensure the lessons were as consistent as possible week to week and between rounds and groups. The same Tai Chi instructor and the same International Poi instructor were used for the duration of the study. Lessons were held at the same time of day, and lasted the same duration, for both groups, during both rounds. Both instructors followed a general lesson plan, though lessons slightly shifted as the instructors adapted to participant feedback. And, as described in Chapter 3, the population of each group was as similar as possible.

Regarding the student teacher relationship, both the poi and Tai Chi group felt positively toward their instructor, as illuminated by responses to Questionnaire 3. Both groups commented on instructor relationship as a positive effect. There were no comments regarding instructor relationship as a negative effect. Participants in the Tai Chi group said "Bruno, the teacher, is extremely good at understanding his [students] and being patient with his teachings", "I have really enjoyed both the

exercises themselves and Bruno’s quiet, calm and reassuring teaching style”, and “Bruno was the perfect instructor – non-judgmental so I didn’t feel foolish if not doing moves correctly.” Participants in the poi group said “Working with Kate has been a joy”, “Kate is also a great leader, her passion for poi is infectious”, and “The non-threatening environment promoted by Kate is extremely important.”

In conclusion, it is not clear if or how differences in the teaching and learning framework, between the poi and Tai Chi group, may have impacted the clinical study results. The Tai Chi group participated in discussions regarding Tai Chi philosophy. The poi group experienced greater participant autonomy. Both groups felt similarly positive toward their instructors. While these are interesting points to note, the goal of the present study was not to measure learning, but rather physical, cognitive, and emotional effects (in the clinical study) and participant perceptions of the intervention (in the follow-up questionnaires).

### 5.3.2 Differences between rounds

This study was conducted in two rounds, and there were a handful of differences between them. While some of the differences were small, they will all be addressed in order to provide complete transparency regarding the study execution.

#### 5.3.2.1 Location

The two rounds of the study were conducted in different locations. Round 1 was conducted at the University of Auckland Tamaki Campus, in two standard classrooms. The larger classroom was used for both the test sessions and the lessons, and the smaller classroom was an additional testing room. Because this study was the only activity occupying the space, the larger classroom became a home

base. There were some decorations on the wall provided by the researcher, comfortable chairs, and natural light. Round 2 was conducted in two different spaces. The test sessions were held in the University of Auckland Clinical Research Centre, which consisted of small white rooms with no decorations and no natural light. The poi and Tai Chi lessons were conducted at the University of Auckland Epsom Campus in a large gymnasium. Because neither of the spaces were used exclusively for the study, there was potentially not the same sense of a home base as in round 1. All of the locations, for round 1 and 2, had parking available and were accessible by public transportation.

### 5.3.2.2 Intervention length

After completing round 1 of the study, which had a one month intervention period, it was decided to extend the intervention period in round 2 to two months. The reason for this extension was to address the potential criticism of the intervention being relatively short in comparison to other research studies with similar interventions. The intervention length affected the amount of test sessions. In round 1, participants completed four test sessions (two before, and two after the intervention). In round 2, participants completed five test sessions (two before, one in the middle of the two month intervention, and two after). The major point of comparison for the clinical study and questionnaire data (baseline to immediately after one month of intervention) was identical for both rounds. When comparing baseline measurements to the two month mark in round 2, the only significant finding that was stable at baseline was the Emotional Well Being domain of the SF-36 ( $P = 0.011$ ). However, there were only 13 participants in the poi group, and 22 participants in the Tai Chi group, available for analysis at the two month mark. This sample is simply too small to draw any meaningful conclusions.

### 5.3.2.3 Tests

There were a number of differences regarding the means of measuring between rounds. First, the 36-Item Short Form Survey was administered with paper and pencil in round 1, and administered via a computer in round 2. If a participant had trouble using the computer, the assessor was available to enter the information on their behalf.

Second, the 30 Second Chair Stand, in which participants were asked to sit in a chair and complete as many full stands as possible within 30 seconds, used a variety of chairs in both rounds. In round 1, a folding chair was used as it complied with the prescribed chair height. After 3 folding chairs were broken, a sturdier substitute chair was used, which was slightly lower with a more cushioned seat. In round 2, one chair was used for the majority of the study, which did not have a cushioned seat and was slightly lower than the folding chair of round 1. During the last post-test this chair vanished, and a substitute chair of similar height but with a cushioned seat, was used. Due to these changes, the results for the 30 Second Chair Stand Test may not be accurate (and the results were not stable between baseline measurements in any case, so they were not readily interpreted).

Third, there was one test administered in round 1 (the Timed Get Up and Go, or TUG), which was not administered in round 2, but rather replaced with the 4 Stage Balance Test. The TUG, a test for balance, involved standing up from a seated position, walking to a line on the floor and around a small ball, walking back to the chair, and sitting down. Participants were instructed to walk at a normal walking speed. This test ultimately proved to be ineffective for this study's population of healthy older adults, as participants had no trouble getting up from the chair or walking around the ball, but instead were very concerned with what a "normal" walking speed was. Some participants were practically running, while others were over exaggerating a relaxed nature and walking quite slowly. Some

participants walked very fast during one test session, and much slower during another. This was not due to a health problem, but due to interpreting “normal” differently on different days (the test sessions were a month apart so it was common for participants to not remember what they had done previously). A different test for balance, the 4 Stage Balance Test, replaced the TUG in round 2. This test involved holding different stances of increasing difficulty for 10 seconds. Because the 4 Stage Balance Test was introduced in round 2, it was only available for that subset of participants in analysis. This is noted in the results section.

Fourth and finally, an additional cognitive test (the Continuous Performance Test, or CPT) was included in the CNS Vital Signs Battery during round 2, and not in round 1. The clinical domain of this test was simple attention. This test was not included in round 1 as the researcher misinterpreted the CNS guidelines regarding which tests were necessary in order to determine the overall Neurocognition Index (NCI). By including the CPT in round 2, participants may have been slightly more fatigued during the cognitive tests as it is the longest test (5 minutes) and requires constant focus. That being said, the CPT was second to last in the cognitive battery, and the cognitive battery itself was the last task to be completed at each test session, so the addition of the CPT likely had minimal, if any, influence on any other outcomes.

#### 5.3.2.4 Poi lessons

While the International Poi lessons in both rounds focused on exploring timing, direction, and plane, along with the same tricks (figure 8, flowers, butterfly, chasing the sun, and pendulum), the pace of the lessons in round 2 was considerably slower. This was in response to two things. First, the longer intervention period in round 2 provided more time for content to be covered. Second, questionnaire feedback from round 1 showed that the poi participants were feeling quite challenged and frustrated. While there will always be an element of challenge and frustration in learning a new skill, more time

was spent getting comfortable with poi foundations in round 2 with the aim of mitigating some of the frustration. The potential influence of this will be further discussed in the analysis section of this chapter.

In round 2, there was also an additional piece of supplementary material for the International Poi group, a guide chart which highlighted the basic principles of timing, direction, and plane, along with showing a simplified version of four tricks (butterfly, pendulum, figure 8, and flower). During round 1, it became apparent that the poi participants were having difficulty remembering the moves and the names of moves. Some impromptu signs with the names of the tricks were hung on the wall. In the break between rounds, a chart was created as a solution. It is not clear if the chart had an impact on the participants' experience in round 2, though we can assume if it did it would be minimal, as the chart was not an integral part of learning poi. As stated in Chapter 2, the primary method of learning was through actively engaging with the activity.

#### 5.3.2.5 Administrative

After round 1, a few processes were automated to lessen the administrative workload and also reduce human error. First, the system for determining participant eligibility was digitized. In round 1, potential participants received information via email or in the mail about the study, and then met with the PI to confirm their eligibility and sign the necessary forms. In round 2, participants began by filling out an online questionnaire which determined their eligibility. If a participant was not eligible, she or he did not progress to the end of the questionnaire and no further steps were taken, unless she or he chose to contact the PI. For those that were eligible, a consent form was sent via email or mail, and participants sent it back digitally or physically. Potential participants were not required to meet with the PI in round 2, though they were encouraged to if desired and the PI held a number of

“open days” in which she was present at a physical location and anyone could stop by to chat or ask questions. In both rounds, the PI’s phone number was available to everyone. In round one, 44 of the 97 volunteers screened, or 45%, participated in the study. In round two, 53 of the 130 volunteers screened, or 41%, participated in the study. This suggests that that the different recruitment process likely did not have an effect on participation.

Second, an online booking and calendar system was used in round 2. This automated the booking of test sessions, which was previously handled by the PI via email in round 1. In addition to making the booking process easier, the automated system in round 2 sent out automatic reminders about upcoming test sessions via email and sms. This system seemed to reduce the number of no-shows, and drastically lessened the workload on the PI.

Third, the 36-Item Short Form Survey was digitized in round 2, and scores were automatically tallied and formatted into the correct output for data analysis. This was done by hand in round 1. If a participant was uncomfortable with the computer, an assessor was available to enter the information on her or his behalf. This difference likely had little effect on the participant’s experience, and drastically reduced the workload for the PI.

### 5.3.3 Limitations

The present study had some limitations, primarily financial support, and control group methodology and design, which will be discussed at further length below. Other potential limitations included time (in terms of how much time participants could volunteer, and in terms of the overall timeline in which the study needed to be complete) and sample size. A longer intervention period and larger sample size may have increased the study’s sensitivity to differences in the effects of the two interventions.

Other delimiting factors included geography (the sample was limited geographically to the greater Auckland, New Zealand area), self-reporting during recruitment (participants were asked to honestly and accurately report the state of their own health during the recruitment process), and the inclusion criteria of age and no previous experience with International Poi or Tai Chi. The two primary limitations, financial support and control group design, will now be discussed at further length.

One major limitation of this research was financial support. The study cost \$20,000 NZD in total, the primary costs being materials (namely the cognitive tests at \$10.75 USD per test), reimbursement for participants time in the form of a \$20 NZD voucher per test session, and staff to execute the test sessions at \$25 an hour. The study was financed by crowd funding, departmental support, loans, and a \$1,000 grant from Fund the Flow Arts. The main consequence of this was a relatively small sample size, only one active control group (discussed in more detail below) and limiting the means of measuring to tools which did not require much, if any, funding. These factors made the results of the trial less robust and thus, may have limited the study's sensitivity to differences in the effects of the two interventions. It should be noted that this was the first study to evaluate the effects of a completely novel intervention, and while innovative research is often celebrated after the fact, finding support at the early stages can be challenging.

Another major limitation was the lack of a third, inactive control group as discussed previously in this chapter. By including an inactive group, it could be confirmed that poi and Tai Chi were both superior to a placebo, or in this case a group that did not participate in any activity (Greene, Morland, Durkalski, & Frueh, 2008). A third group would also allow us to check for practice effects of the assessments over all four assessment time points. Due to the constraints of time and money, this was

not a viable option. However, measures were taken to ensure that the study design, using two groups, was as rigorous as possible. This was done in the following ways:

1. Choice of control group type: By comparing International Poi to an active control group, we can show the efficacy of International Poi by demonstrating that it is as good as a known effective treatment (ICH Topic E 10, 2001). This method is known as noninferiority design (Greene et al., 2008). Choosing an active control group is consistent with other research which investigates novel interventions.
2. Choice of control group activity: While determining the control group was a challenging process, with no quintessential solution, a sound methodology was used to guide this decision (see Chapter 3). In choosing Tai Chi, the present study addresses the key methodological issues set forth by Greene et al. (2008). These issues are: 1) The active control must be a well-established standard treatment, 2) There must be convincing and consistent evidence which proves the active control's efficacy against a placebo, 3) The active control must be effective in the specific application, ideally with the same population, as the current research (Greene, 2008). Tai Chi fulfills all of these guidelines, and thus is a robust comparison for International Poi.
3. Conditions of the trial: The conditions of the trial, such as setting and duration, did not unfairly favor one group over the other.
4. Baseline measurements: Two baseline measurements were taken prior to the intervention, and stability was assessed between them. Only measures which were stable between the two baseline measures were further analyzed.

While the aforementioned steps were taken to ensure rigorous control group methodology, the choice of Tai Chi for the active control group is still problematic. Part of the methodology behind

choosing the control group was to compare related activities to International Poi (see Chapter 3). This process involved determining what characteristics were absolutely essential to an activity, and proved to be particularly difficult. For example, is ambidexterity essential for ballroom dancing? Is meditative movement essential for juggling? The answers to many of these questions teetered between “yes” and “no”, and the final decision was ultimately left to the subjective discretion of the researcher. However, it should be emphasized that of all the potential control groups considered, Tai Chi was clearly the most appropriate due to the requirements listed in #2 above.

## 5.4 Summary

This chapter discussed the methodology, analysis, and limitations of the present study. It began by discussed the teaching and learning framework, primarily the philosophy and cultural context of Tai Chi, and participant autonomy during International Poi lessons. Second, it discussed the differences between the two rounds, in order to provide complete transparency regarding the study execution. Third, it presented some potential limitations, primarily financial support and control group methodology and design. To follow is the conclusion of this thesis, which will discuss implications for future research, policy, and practice.

# 6. Conclusion

## 6.1 Chapter overview

Due to a rapid increase in population ageing, there is currently a great deal of interest in promoting health and wellbeing specifically amongst older adults. There are a multitude of approaches to maintaining or improving health, such as drugs, diet, social interaction, and physical and mental exercise. This study suggests that International Poi, which can encompass social interaction and physical and mental exercise, has the potential to not only improve individual health and wellbeing, but also prolong active participation in society and attenuate health system pressures. The following chapter will discuss the implications for future research, policy, and practice.

## 6.2 Implications for future research

This research demonstrated that the possibilities for future research on poi and health are vast, and the need for such research is paramount. This section will discuss the potential of directly building upon the present study in a subsequent study, other avenues of potential future research on International Poi and health, and considerations around future research in regard to Māori health specifically.

## 6.2.1 Building upon the present study

One approach to conducting future research on poi and health is to use the methodology and results of the present study to guide a subsequent study. By directly building upon the present study, replication of results and understanding the potential long-term benefits of International Poi can be focused on. In order to maintain consistency and eliminate some of the potential limitations of the present study, the following guidelines are suggested for a subsequent study.

- Sample: In order to maintain consistency with a focus on results replication, it is suggested that the sample of the study remain the same (healthy adults over 60 years old).
- Sample size: A larger sample size is recommended, and sample size calculations should be used to determine an appropriate size to generate reliable data.
- Control groups: It is recommended that the two groups of the present study remain (International Poi treatment group, Tai Chi active control group) and a third, inactive control is added.
- Variables: In order to focus on results replication, it is recommended that the measures which improved immediately post intervention (postural stability, upper limb strength, simple attention, and blood pressure) are the focus of a subsequent study.

While conducting a subsequent study as suggested above is one avenue for future research, other possibilities will be discussed below.

## 6.2.2 Other avenues for future research

While building upon this thesis is a recommended avenue for future research, there are a multitude of other approaches which could involve changing a number of variables such as the population

sampled, control activity, means of measuring, and variables being measured. Some suggestions for other avenues of future research are as follows.

- Replicate the present study with a healthy population of a different age group (i.e. middle age adults, teenagers, younger children).
- Replicate the present study with a population that has a physical, cognitive, or emotional impairment (i.e. stroke, dementia, depression, ADHD).
- Replicate the present study with a different control group (i.e. juggling, ballroom dancing, drum circles, Wii fit, yoga).
- Replicate the present study with different means of measuring the same variables, or measuring different variables.

Once a reasonable body of rigorous scientific research has been established for International Poi as a health intervention, different flow arts could be considered to replace International Poi--“flow arts” being an umbrella term for the intersection of a variety of movement-based disciplines. Examples of other flow arts to consider are hooping, staff, or juggling.

### 6.2.3 Māoridom

As noted in the literature review, Māori Poi practitioners are already well aware of the physical, cognitive, emotional, and spiritual benefits of poi. It should be clearly stated that the following section is not an attempt to tell Māori something they don’t already know about poi, but rather to weave together medical and Māori discourse, which may potentially create new possibilities for poi practice within the field of health and wellbeing, within and outside of Māoridom.

In order to understand how the present research (or future research in a similar vein) might impact Māori, it is important to understand wellbeing in a Māori context. Māori wellbeing is not simply the absence of poor health, but a holistic concept which encompasses physical, mental, social, and spiritual realms known as Hauora (Ministry of Education, 2007; Moon, 2012). While many components can be used to assess and describe Māori wellbeing, some of the most integral and frequently mentioned in literature on Hauora are strength of cultural identity and purpose (protection of Māori identity, retention and use of Māori knowledge), whanaungatanga (family), connectedness to community and the environment, resolution of land and sovereignty issues, and balance between the physical and spiritual realms (Moon, 2012). All of the dimensions of Hauora support and influence each other (Ministry of Education, 2007). Further research and consideration regarding wellbeing in a Māori context would be necessary if future research on poi and Māori health were to come to fruition, but the definition above provides a necessary groundwork for the following discussion on the potential of poi as an exercise tool for older Māori adults.

The proportion of Māori aged 65 and older is projected to increase by 115 percent (37,000) by 2026 (Office for Senior Citizens, 2015). The ageing Māori population has significantly higher rates of diabetes, high blood pressure, cardiovascular disease, cancer, and a shorter life expectancy than non-Māori populations in New Zealand (Ministry of Health, 2011). This may potentially be due to the lack of exercise opportunities in New Zealand provided in a whānau based context. Whānau is an essential building-block of Māori society, and is traditionally considered immediate family and an extended social unit based on kinship ties (Walker, 1990). In this thesis, Paul Moon's broader and more modern definition of whānau will suffice:

A broad entity, based on ancestral connections, but also (either alternatively or complementarily) on modern geographical or social collectives, or at its most extreme, simply a shared sense of belonging to the group. (Moon, 2012, p. 5)

Whānau is a supply of strength, safety, and identity, and is fundamental to individual and collective Māori wellbeing (Biddlecombe, 2013).

While many physical and mental health programs have been aimed at Māori populations in New Zealand, there are much fewer approaches offered in a whānau context that utilize activities found within Māori culture. A book on physical activity among Māori, Pacific, and low-income families by Sharron Bowers et al. (2009) includes interviews from Māori populations about the current exercise programs available:

Informants reported that many of the current programmes and policies were failing Māori. Specifically it was stated that 'New Zealand hasn't done much in the "as Māori" space for physical activity'. The term 'as Māori' was explained as being either an environment like the marae or a philosophical space. Two informants commented on the lack of cultural capacity in mainstream physical activity programmes. One commented that programmes currently offered by the Regional Sports Trusts 'are not responsive to the diverse realities of many Māori families' such as access to facilities, the time of day that the programmes are offered, safety issues, and affordability. The Pacific informant commented that a barrier for Pacific people is 'cultural shyness' and that people who run, or plan to run physical activity programmes for Pacific people need to consider this when planning or sharing facilities with mainstream use. As they noted, 'we don't work out in our bikini in the pool'. (p. 166)

As a culturally specific activity, poi may address the aforementioned concerns. Poi may also address other concerns of the ageing Māori population, such as having varying intensity levels (e.g., you can use one poi sitting down, or use two poi while dancing), being tailored to the individual (e.g., poi can be short or long, heavy or light), and avoiding transportation issues (poi can be used anywhere and does not require a special facility) (Biddlecombe, 2013). Māori interviewees also reported that a community development model would be the most successful for getting more Māori physically active (Bowers et al., 2009).

Thus, it is suggested that future research on poi and Māoridom be conducted. The possibilities for future research within Māoridom are numerous. A few suggestions are as follows:

- Replicate the present study with Māori Poi instead of International Poi.
- Replicate the present study with Māori Poi and a population of healthy older Māori adults.
- Replicate the present study with Māori Poi and a population of older Māori adults with cognitive impairment.
- Include a Māori Poi group in the subsequent study suggested at the beginning of this section.

Because the present study is a scientific evaluation of the effects of poi on health, it may speak to the medical community in a way that Māori literature and discourse may not. Though the aim of this research is not to uncover something which Māori do not already know about poi and wellbeing, it may shed new light on a Māori taonga, and potentially further validate or substantiate what is known inside of Māoridom to those outside. Though the main focus of this thesis was to collect and analyze data on physical, cognitive, and emotional health through a scientific study, and not predict the potential implications of the data collected, the researcher does hope this thesis will have a positive impact in the Māori community, and lay the groundwork for future studies on poi and health in Māoridom.

## 6.3 Implications for policy and practice

“As life expectancies increase, it is more important than ever to enact policies that promote lifelong health and emphasize preventive care” (United Nations, 2015, p. 100).

The first step toward a comprehensive public-health policy will be to focus on optimizing functional ability (The World Health Organization, 2015). At a population level this means finding strategies to raise overall levels of ability, paying close attention to those with the least resources and/or lowest ability. On an individual level this means policies, systems, and services that can optimize functional

ability across the life course (The World Health Organization, 2015). This thesis is the first step toward establishing the efficacy of poi as a tool for improving health and wellbeing for healthy older adults. Once a large, robust evidence base has been established for poi and health, then policy makers and practitioners may want to consider pursuing some poi-health initiatives. In regard to older adults specifically, it is recommended that local and national governments consider providing funding for poi, health, and ageing initiatives. Poi could be included as a government recommended preventative or rehabilitative activity for older adults, just as Tai Chi classes aimed at older adults who are particularly vulnerable to injury through falls, for example, are funded by the New Zealand government (Campbell & Robertson, 2010). Poi could be included in physical education and health curricula targeted at older adults, such as programs delivered through community centers. And in general, awareness around the health benefits of poi could be raised globally, through organizations such as the World Health Organization.

Beyond the scope of older adults, other initiatives might include:

1. Poi as an area of study within university physical education and health departments;
2. Poi as part of corporate wellness programs; and,
3. Programs on the benefits of poi as a tool to improve health within continuing education programs for health practitioners.

Regarding public health action, there are things every country can do irrespective of their current situation or level of development (World Health Organization, 2015). International Poi is an inexpensive, simple, customizable activity which is globally accessible. This thesis provides promising data regarding its implications on maintaining or improving health in old age, and given future

research confirms these findings, policy makers and practitioners are urged to investigate poi-health initiatives.

## 6.4 Summary

The possibilities for future research on poi and health are vast, and the need for such research is paramount in order to replicate the results of the present study, better understand potential long-term benefits, and begin to make recommendations for policy makers and practitioners regarding poi-health initiatives. This chapter suggested potential implications for future research such as building upon this thesis, branching out from this thesis, and specifically investigating Māori Poi and poi-health research in a Māori context. This chapter also suggested potential implications for policy and practice specific to older adults as well as to a broader audience.

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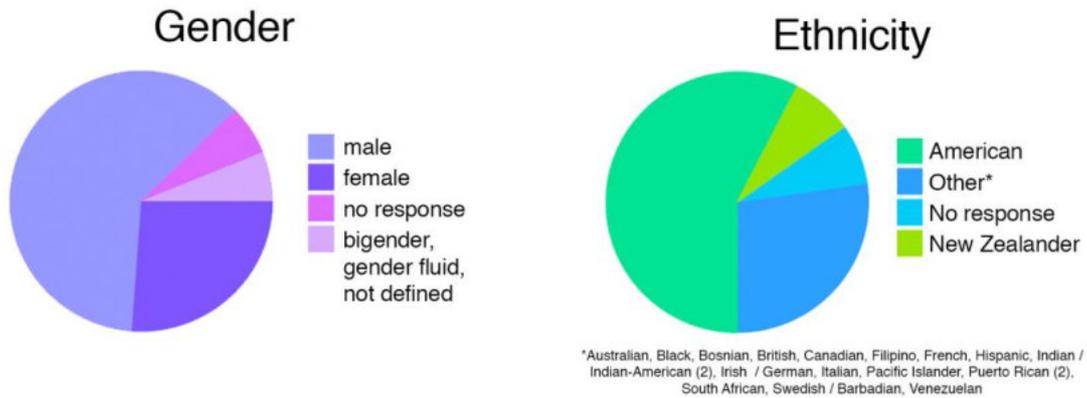
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## Appendix A. International Poi Terminology

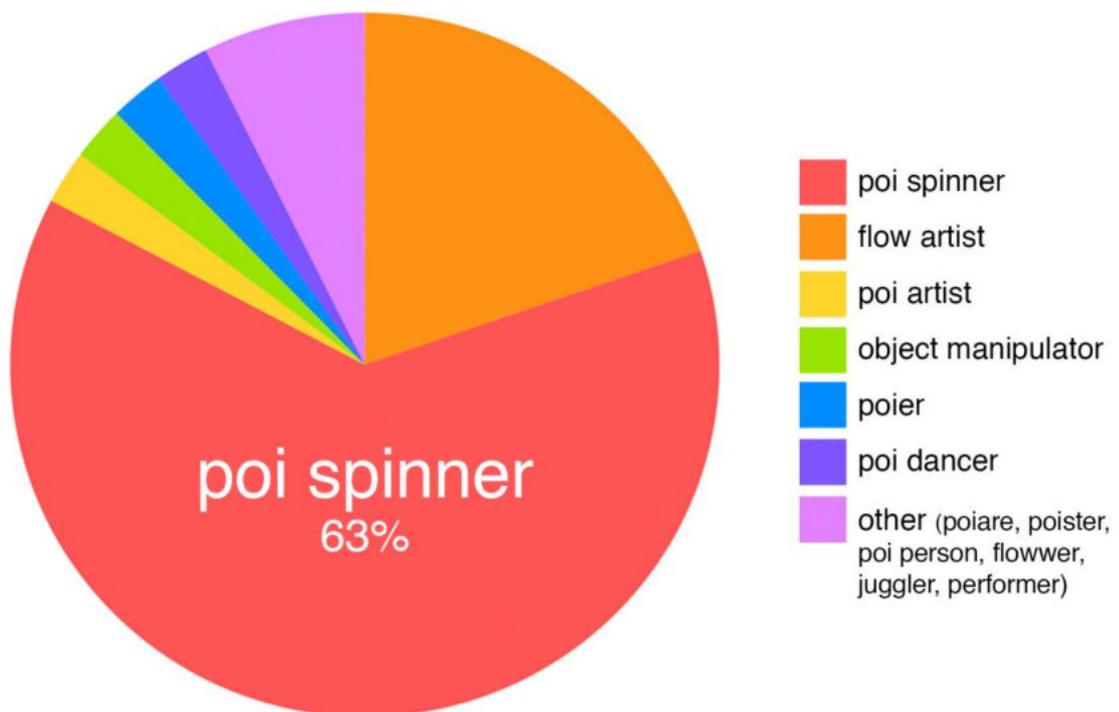
Survey respondents were members of the group “Poi Chat”, an online community of International Poi artists. The survey asked the following questions, with 1 - 3 being optional:

- 1) What is your age?
- 2) What is your gender identity?
- 3) What is your nationality?
- 4) What do you typically call a person who does poi, e.g. poi spinner, poi dancer, flow artist?
- 5) What do you typically call the act of doing poi, e.g. poi spinning, flowing?
- 6) What do you typically call the skills demonstrated with poi, e.g. moves, tricks?
- 7) What do you typically call the type of poi practiced specifically by the Maori people of New Zealand, e.g. Maori poi, traditional poi?

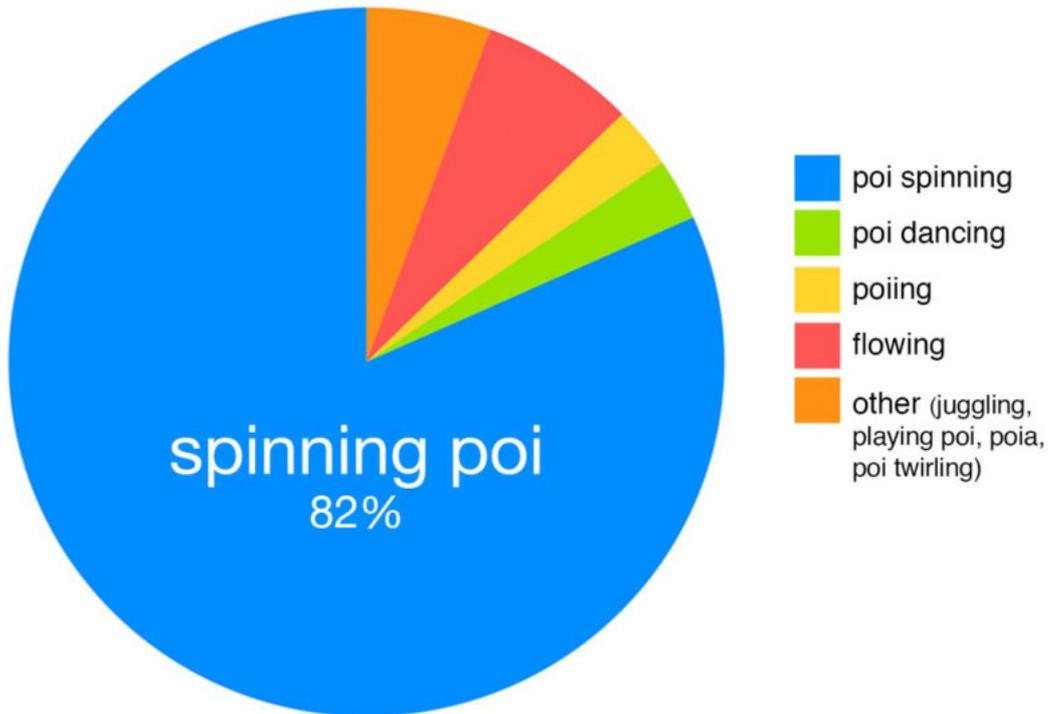


Average age: 27

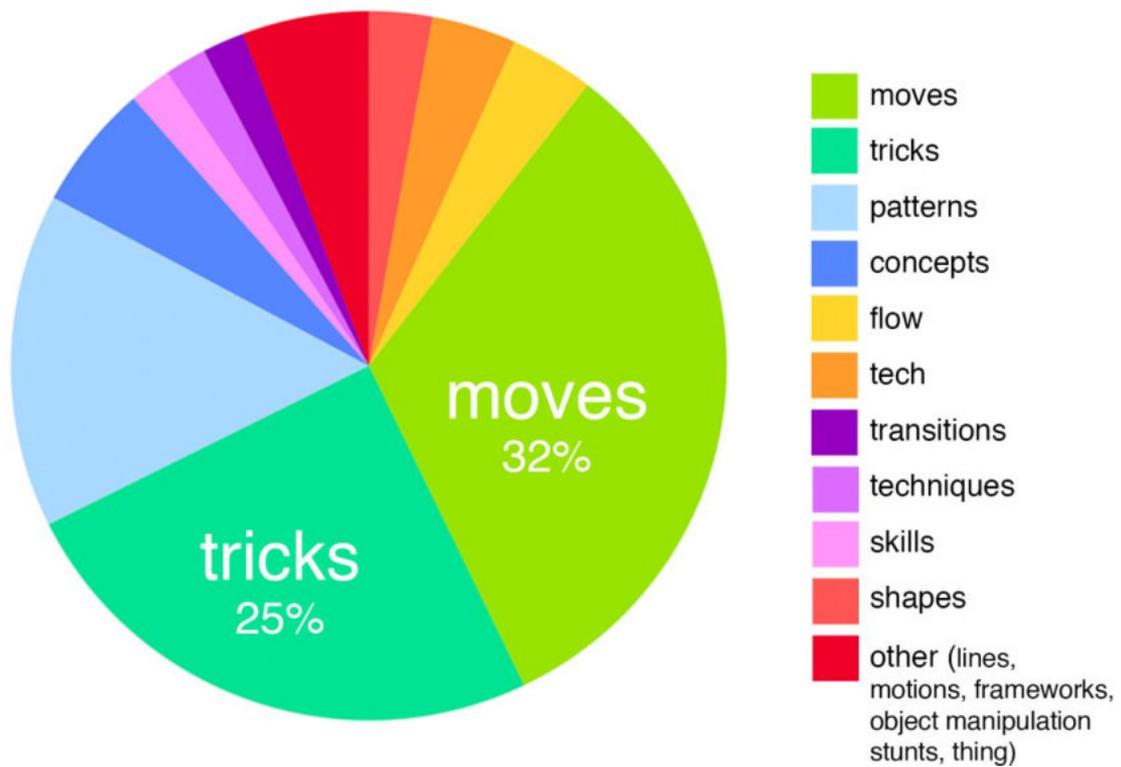
## a person who does poi?



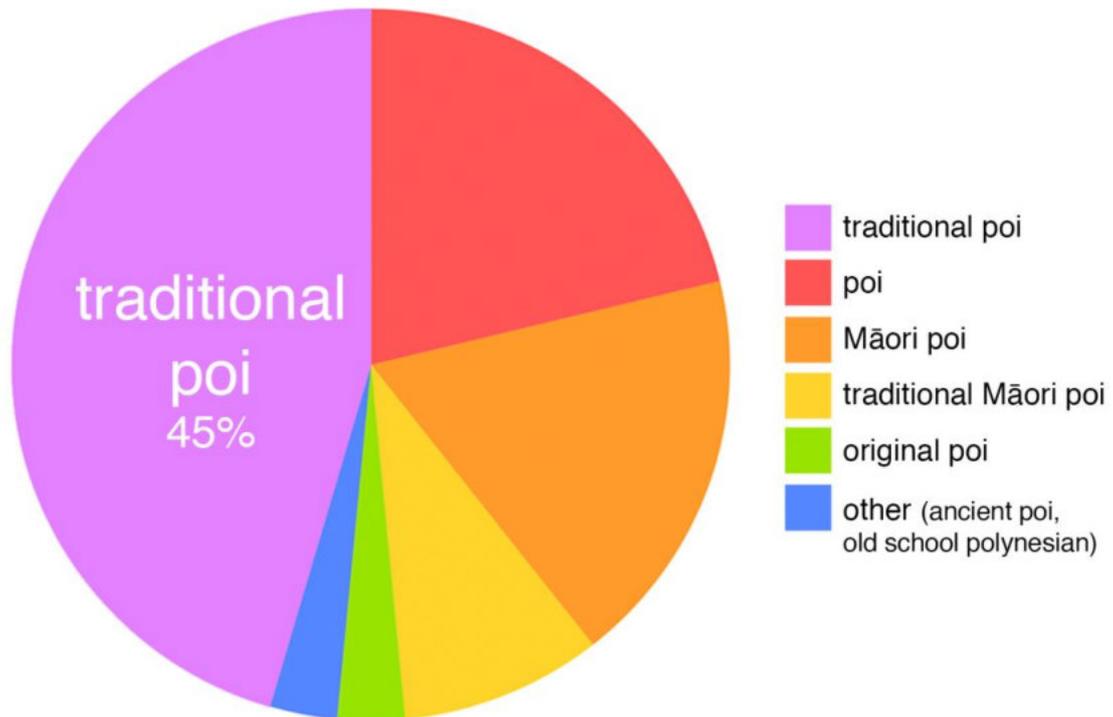
## the act of doing poi?



## the skills demonstrated with poi?



the type of poi practiced by the Māori of New Zealand?



Appendix B. Exercise pre-screening, participant  
information sheet, and consent form



## PARTICIPANT INFORMATION SHEET

### PROJECT TITLE

The Effects of International Poi and Tai Chi on  
Physical and Cognitive Function in Healthy Older Adults

### RESEARCHERS

Kate Riegle van West, PhD candidate in Dance Studies  
A/Professor Ralph Buck, Faculty of Dance Studies  
A/Professor Cathy Stinear, Faculty of Medical & Health Sciences

**You are invited to take part in a study about the effects of International Poi and Tai Chi on physical and cognitive health.**

We are conducting research that explores if International Poi (swinging a weight on the end of a cord in circular patterns) has an effect on physical and/or cognitive ability in healthy older adults. The study will involve a series of non-invasive physical and cognitive tests, plus International Poi lessons (treatment group) or Tai Chi lessons (control group). Please take your time when thinking about the information below, and feel free to discuss it with your whānau, family, and friends. Taking part in this study is completely voluntary and you may withdraw at any time without giving a reason. This document will provide you with the following information:

1. Who is conducting the study?
2. What does the study involve?
3. Am I eligible to participate?
4. When will the test sessions and lessons take place?
5. Where will the test sessions and lessons take place?
6. Who will be teaching the lessons?
7. What if I want to try both International Poi and Tai Chi?
8. What do the test sessions involve?
9. What are the benefits and risks?
10. Will I be reimbursed for my travel?
11. Compensation in the event of injury
12. Confidentiality
13. Summary of your rights
14. Who should I contact if I have further questions?

### **1. Who is conducting the study?**

Kate Riegle van West, a PhD candidate at the University of Auckland, will be conducting the study under the supervision of Associate Professor Ralph Buck (Dance Studies) and Associate Professor Cathy Stinear (Faculty of Medical & Health Sciences). Associate Professor Buck's research and teaching focuses on dance education curriculum, dance pedagogy and community dance. Associate Professor Stinear's research specialisation is in neuro-rehabilitation, human neurophysiology and neural plasticity. Kate's research expertise lies in International Poi and Interdisciplinary Art and Media. Her experience includes running a centre for International Poi where she also taught International Poi lessons, creating a musical instrument rooted in International Poi during her Master's degree, and giving a TEDx talk about the potential impact of International Poi as a musical instrument as well as its greater potential to positively effect well-being.

### **2. What does the study involve?**

If you agree, and are eligible to participate in this study, you will be asked to:

- Complete an online eligibility questionnaire which will ensure you are eligible and can safely participate in the study (approximately 10 minutes).
- Be randomly assigned to either the International Poi or Tai Chi group.
- Take part in International Poi or Tai Chi lessons twice a week for 2 months. Each lesson will take approximately one hour, and you will be in a group with 4 -10 other study participants. Lessons will be between 10am – 3pm, during the end of March through May 2017.
- Take part in five, 1.5 hour test sessions to measure your physical and cognitive functioning. All tests used to measure physical and cognitive ability will be non-invasive.

### **3. Am I eligible to participate?**

- You may be eligible to participate if you are at least 60 years old.
- You may not be eligible to participate if you have balance or musculoskeletal disorders, or have had previous International Poi or Tai Chi lessons. We will need to discuss this with you further.
- You will not be able to participate if you have a neurological disorder.

If you aren't eligible to participate, then any documents relating to you will be immediately destroyed.

### **4. When will the test sessions and lessons take place?**

You will be asked to complete five test sessions in 2017: one in February, one in March, one at the end of April – beginning of May, one in June, and one in July. Each session can be completed any time during a 3 week window. This means you can pick the best day and time for you. The windows when test sessions can be completed are shown in orange on the calendar graphic below.

The International Poi and Tai Chi lessons will take place from the end of March through May 2017. You will be asked to attend lessons twice a week. All lessons will be held on week days between 10:00am and 3:00pm. More specific day and time details will be discussed at the end of February. On the calendar below, the weeks when lessons will happen are shown in blue.

# INTERNATIONAL POI / TAI CHI STUDY CALENDAR

- Test sessions: you will come in for one, 1.5 hour test session once a month
- Lessons: you will come in twice a week for a one hour Poi or Tai Chi lesson

## February

SUN	MON	TUES	WED	THURS	FRI	SAT
	30	31	1	2	3	4
5	6 Waitangi Day	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

Pre-test 1

## March

SUN	MON	TUES	WED	THURS	FRI	SAT
	27	28	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
26	27	28	29	30	31	

Pre-test 2

Lessons

## April

SUN	MON	TUES	WED	THURS	FRI	SAT
	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14 Good Friday	15
16	17 Easter Monday	18	19	20	21	22
23	24	25 Anzac Day	26	27	28	29

Lessons

Mid-test

## May

SUN	MON	TUES	WED	THURS	FRI	SAT
	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	26	27
28	29	30	31			

Lessons

## June

SUN	MON	TUES	WED	THURS	FRI	SAT
				1	2	3
4	5 Queen's Birthday	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Post-test 1

## July

SUN	MON	TUES	WED	THURS	FRI	SAT
						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	26	27	28	29

Post-test 2

### **5. Where will the test sessions and lessons take place?**

The International Poi and Tai Chi lessons will take place at the University of Auckland Epsom Campus (74 Epsom Ave, Epsom, Auckland) in one of the gymnasiums. The test sessions will take place at the University of Auckland Clinical Research Centre (85 Park Road, Grafton, Auckland).

### **6. Who will be teaching the lessons?**

The International Poi lessons will be taught by Kate Riegler van West. Kate has over a decade of experience teaching and performing with International Poi in the U.S. The Tai Chi lessons will be taught by Bruno Rubini, a full time Auckland area instructor with over 30 years of Tai Chi Chuan experience, who will sign a confidentiality agreement.

### **7. What if I want to try both International Poi and Tai Chi?**

Because you will be randomly assigned to either the International Poi group or Tai Chi group during the study, we would like to provide the opportunity to switch groups once the study is complete. This will allow you to learn and participate in both activities if you so choose. This is completely optional, and you will be given more details and time to decide if you would like to do so once the study is complete.

### **8. What do the test sessions involve?**

The test sessions for this study will use the following procedures:

- Blood pressure measured with a standard cuff and stethoscope
- Heart rate taken by manually measuring pulse
- Balance measured with the functional reach test and static balance tests. The functional reach test involves leaning forward as far as possible without losing balance. The static balance tests involve balancing in various standing postures such as feet together, feet together with eyes closed, and on one leg. Approx. 5 minutes to complete.
- Manual dexterity measured with a grooved peg board test, which involves putting small pegs into holes. Approx. 5 minutes.
- Lower body strength measured with the chair stand test, which involves standing up from a seated position in a chair as many times as possible in 30 seconds.
- Grip strength measured with a pinch grip and hand grip dynamometer. Both tests will involve squeezing the dynamometer as hard as you can. Approx. 3 minutes for 5 trials.
- Upper limb range of motion measured with a goniometer. This involves using a protractor to measure how far your shoulder, elbow, and wrist joints can comfortably move. Approx 5 minutes.
- Bimanual coordination measured with the circle tracing test. This will involve tracing circles with your fingers on a digital tablet. Approx 10 minutes.
- Cognitive ability (complex attention, cognitive flexibility, reaction time, psychomotor speed, and working memory) measured with the CNS cognitive battery. This will involve taking a series of cognitive tests using a computer. The tests will take approximately 30 minutes to complete.
- Psychological well-being measured with a SF36 questionnaire, which will involve answering a series of questions on a questionnaire. Approx. 5 minutes.

### **9. What are the benefits and risks?**

You will have the opportunity to complete 8 weeks of free International Poi lessons or free Tai Chi lessons. You may also experience improvements in cognitive and physical function. The activities are intended to be fun and engaging. You will also be given \$100 worth of petrol vouchers for travel to and from the study.

The possible risks include losing balance and falling during lessons. This is minimised by tailoring the activities to each participant's needs, under the instruction of experienced trainers. For example, International Poi can be carried out in a seated position if required. You will also be screened for health problems that could affect your participation in the study, such as dizziness, a history of falls, and joint pain, to help decide if this study is right for you. The space for lessons will be large and free of furniture, so that you will be able to move freely, and lessons will take place during normal working hours, when First Aid certified staff are available in the building.

### **10. Will I be reimbursed for my travel?**

Yes, you will be offered reimbursement for your travel expenses in the form of \$100 worth of petrol vouchers (the vouchers may be redeemed for other goods at the petrol station). You will receive one \$20 voucher at each test session. If you withdraw from the study you may keep the vouchers already given to you, but will not be eligible to receive any further vouchers.

### **11. Compensation in the event of injury**

In the unlikely event of a physical injury as a result of your participation in this study, you may be covered by ACC under the Injury Prevention, Rehabilitation, and Compensation Act 2001. ACC cover is not automatic, and your case will need to be assessed by ACC according to the provisions of the Injury Prevention, Rehabilitation, and Compensation Act 2001. If your claim is accepted by ACC, you still might not get any compensation. This depends on a number of factors, such as whether you are an earner or non-earner. ACC usually provides only partial reimbursement of costs and expenses, and there may be no lump sum compensation payable. There is no cover for mental injury unless it is a result of physical injury. If you have ACC cover, generally this will affect your right to sue the investigators. If you have any questions about ACC, contact your nearest ACC office or the investigator.

### **12. Confidentiality**

No material that could personally identify you will be used in any reports in this study. The information and data collected from you will be stored securely, in locked cabinets and on secure computer networks for six years. Only the researchers will have access to this information, and your data will be de-identified by assigning a unique code to it. After six years, your data will be deleted from electronic file and your consent form and all related paperwork will be securely disposed of.

### **13. Summary of Your Rights**

Your participation is voluntary (your choice). You may withdraw from participating at any time without stating a reason. You have the right to withdraw your data from this study up to 3 months after you complete the study. If at any time you wish to do so, please contact Kate Riegle van West for further instructions. Your agreement to participate will be obtained in writing on a Consent Form. You can request a summary of the study's results, which we will send to you once the project is complete.

To summarize:

- Your participation is entirely voluntary.
- You may withdraw from the project at any time without stating a reason.
- You may have your data withdrawn from the study within three months of your completion.
- You may obtain results regarding the outcome of the project from the researchers upon completion of the study.
- Your identity will be kept strictly confidential, and no identification of you or your data will be made at any time during collection of the data or in subsequent publication of the research findings.
- After six years, your data will be deleted from electronic file and your consent form and all related paperwork will be securely disposed of.
- Discomfort or incapacity have not been reported from any of the procedures that will be used in this project, however, if the procedures cause you concern, you may withdraw from the project at any time.
- You are encouraged to consult with your whanau/family, hapu or iwi regarding participation in this project.

### **14. Who should I contact if I have further questions?**

If you have any further questions about the study, or would like to participate in this study, please contact:

**Kate Riegle van West**

PhD Researcher  
Email: krie192@aucklanduni.ac.nz  
Phone: 021 020 05965  
2/26 Allen Road, Grey Lynn  
Auckland NZ 1021

**Associate Professor Ralph Buck**

Head of Dance Studies  
Research Study Supervisor  
Email: r.buck@auckland.ac.nz  
Phone: 64 9 3737 599 ext 82529

For any queries regarding ethical concerns you may contact:  
The Chair, The University of Auckland Human Participants Ethics Committee  
Telephone 09 373-7599 ext 83711  
Email: ro-ethics@auckland.ac.nz  
The University of Auckland Research Office, Private Bag 92019  
Auckland 1142

Thank you for your time and consideration!

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE  
ON NOVEMBER 24<sup>th</sup>, 2015, FOR A PERIOD OF 3 YEARS.  
REFERENCE NUMBER 014986.



## CONSENT FORM

### PROJECT TITLE

The Effects of International Poi and Tai Chi on  
Physical and Cognitive Function in Healthy Older Adults

### RESEARCHERS

Kate Riegle van West, PhD candidate in Dance Studies  
A/Professor Ralph Buck, Faculty of Dance Studies  
A/Professor Cathy Stinear, Faculty of Medical & Health Sciences

### By signing this consent form, you are making the following statements:

1. I have read and I understand the information sheet for volunteers taking part in the study, which explores the effects of International Poi and Tai Chi on physical and cognitive function in healthy older adults.
2. I have had sufficient time and opportunity to discuss this study with the PI (Kate Riegle van West), and am satisfied with the answers I have been given.
3. I have had sufficient time and the opportunity to discuss this project with family / whānau, or with a friend to help me ask questions and understand the study.
4. I understand that taking part in this study is voluntary (my choice).
5. I understand that I will be randomly assigned to either the Poi or Tai Chi group
6. I understand I may withdraw from the study at any time without giving a reason.
7. I understand that I can withdraw any information traceable to me from this study, up until three months after I have completed this study.
8. I understand that after six years, my data will be deleted from electronic file and this consent form and all associated paperwork will be securely disposed of.
9. I understand my participation and my information used in this study is confidential and no material that could identify me will be used in reports of this study.
10. I understand that the contracted Tai Chi instructor will sign a confidentiality agreement.
11. I understand that my participation will be stopped if it should appear harmful to me.
12. I understand the compensation provisions for this study, which amount to one \$20 petrol voucher at each test session, equaling a total of \$100 in petrol vouchers upon completion of the study.
13. I have had time to consider whether to take part.
14. I know whom to contact if I have any side effects from the study.
15. I know whom to contact if I have any questions about the study.

### I agree to take part in this research during which I will be asked to:

- Complete an online eligibility questionnaire that will ensure I can safely participate in the procedures.
- Take part in sixteen, hour long International Poi lessons or Tai Chi lessons over the course of 8 weeks at the University of Auckland Epsom Campus.
- Take part in five, 1.5 hour test sessions to measure my physical and cognitive ability at the University of Auckland Clinical Research Centre (Grafton)
- Notify the experimenter if at any time I feel uncomfortable or unsure of the research procedures being used.

The total time required for the study is approximately 30 hours spread over six months. (sixteen, hour long International Poi or Tai Chi sessions, and five, 1.5 hour test sessions)

**I would like the researchers to inform my GP of my participation in this study:**

(please circle)      YES              NO

If YES: GP name and clinic \_\_\_\_\_

\_\_\_\_\_

**I would like the researchers to send me a summary of the study results:**

(please circle)      YES              NO

If YES: my email address is \_\_\_\_\_

**I hereby consent to take part in this study.**

Signed: \_\_\_\_\_

Name: \_\_\_\_\_  
(please print in full)

Date: \_\_\_\_\_

FOR THE PRINCIPAL INVESTIGATOR -

**Project explained by:** \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

# ADULT PRE-EXERCISE SCREENING TOOL

This screening tool does not provide advice on a particular matter, nor does it substitute for advice from an appropriately qualified medical professional. No warranty of safety should result from its use. The screening system in no way guarantees against injury or death. No responsibility or liability whatsoever can be accepted by Exercise and Sports Science Australia, Fitness Australia or Sports Medicine Australia for any loss, damage or injury that may arise from any person acting on any statement or information contained in this tool.

Name: \_\_\_\_\_

Date of Birth: \_\_\_\_\_ Male  Female  Date: \_\_\_\_\_

## STAGE 1 (COMPULSORY)

AIM: to identify those individuals with a known disease, or signs or symptoms of disease, who may be at a higher risk of an adverse event during physical activity/exercise. This stage is self administered and self evaluated.

Please circle response

1.	Has your doctor ever told you that you have a heart condition or have you ever suffered a stroke?	Yes	No
2.	Do you ever experience unexplained pains in your chest at rest or during physical activity/exercise?	Yes	No
3.	Do you ever feel faint or have spells of dizziness during physical activity/exercise that causes you to lose balance?	Yes	No
4.	Have you had an asthma attack requiring immediate medical attention at any time over the last 12 months?	Yes	No
5.	If you have diabetes (type I or type II) have you had trouble controlling your blood glucose in the last 3 months?	Yes	No
6.	Do you have any diagnosed muscle, bone or joint problems that you have been told could be made worse by participating in physical activity/exercise?	Yes	No
7.	Do you have any other medical condition(s) that may make it dangerous for you to participate in physical activity/exercise?	Yes	No

IF YOU ANSWERED 'YES' to any of the 7 questions, please seek guidance from your GP or appropriate allied health professional prior to undertaking physical activity/exercise

IF YOU ANSWERED 'NO' to all of the 7 questions, and you have no other concerns about your health, you may proceed to undertake light-moderate intensity physical activity/exercise

I believe that to the best of my knowledge, all of the information I have supplied within this tool is correct.

Signature \_\_\_\_\_

Date \_\_\_\_\_

## Appendix C. Tai Chi handouts



## Activating the Tendons

### WHY THE TENDONS?

Tai Chi practitioners aspire to be like “steel wrapped in cotton.” This describes a state in which the muscles are relaxed, as soft as cotton, while the tendons, ligaments, and bones underneath are extremely strong. Mastering the Tendon Activation Form, which involves “changing the tendons,” is critical to attaining this quality of steel wrapped in cotton.

Tendons join muscles to bones. Most tendons are composed of dense connective (collagenous) tissue. This silvery white tissue also forms the ligaments (which attach bones to other bones), the deep fasciae (sheets of connective tissue wrapped around muscles to hold them in place), and the membranous capsules surrounding the kidneys, heart, testes, liver, and lymph nodes. Connective tissue is extremely strong yet pliable. The lungs, vocal cords, and

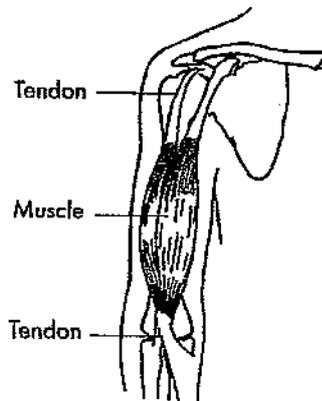


Fig. 10.1 Tendons and muscle

ligaments between successive vertebrae are composed of a more elastic connective tissue.

Medical research has recently discovered the load-bearing function of these connective tissues. The tendons and ligaments can actually bear loads much more efficiently than muscles can. Practical experience in martial arts revealed this fact to the Chinese long ago. Hence, the Chinese emphasize training tendons over building the big bulky muscles that are taken as a sign of physical fitness in the West today.

Maintaining the muscles requires the consumption of large quantities of food, particularly protein. Exercise must be extremely vigorous to increase muscle bulk. This type of exercise would tend to cause one to expend, rather than gain, chi. Overemphasizing the muscles in training eventually results in restricted mobility. Muscle-bound athletes are notoriously inflexible.

Muscles necessarily deteriorate with age, which puts to waste much of the effort spent in building them. By contrast, the tendons, when trained, maintain their strength and flexibility. Furthermore, the rubbery quality of the tendons allows them to store power (*jing*) when twisted. Maintaining springy, flexible tendons can prevent the stiffness that usually accompanies old age.

Tai Chi Chi Kung uses the body's structure, coordinated by tendon movement, to achieve tremendous power with very little effort. The effectiveness of using the whole body to push an opponent is easily demonstrated. If you were to attempt to push someone using just one finger, you would strain much and accomplish little. Incorporate the rest of your hand by bending your wrist, and you find you can exert more pressure with less effort. Add the force of your entire arm, and you increase your power exponentially.

In the Tendon Activation Form, the tendons and ligaments are used to transmit a wavelike force. The push issues out of the ground and passes through the feet, legs, spine, and arms. The force is multiplied as it passes through the body. With so much force concentrated in so small an area (in this case, one fingertip), real damage can be inflicted.

Training and strengthening the tendons is traditionally called Changing the Tendons. In the Universal Tao system, the complete practice of Changing the Tendons is taught in Iron Shirt Chi Kung II. Changing the tendons does not mean physically replacing them. Instead, the weak tendons are made strong, yet flexible.

The entire physical system, especially the joints, is affected by this training. Over time a weak body is changed into a strong one with an abundant supply of chi. As the joints open they become filled with chi. Chi is led to the marrow and brain to nourish them in a practice called Washing the Marrow,

The following article was written by Bill Douglas, founder of World T'ai Chi & Qigong Day (held in 50 nations each year), and has authored and co-authored several books including a #1 best selling Tai Chi book "The Complete Idiot's Guide to T'ai Chi & Qigong." Bill's been a Tai Chi source for The Wall Street Journal, New York Times, etc. You can learn more about Tai Chi & Qigong, and also contact Bill Douglas at <http://www.worldtaichiday.org>

## High Blood Pressure and Tai Chi Therapy

By Bill Douglas

Way back in 2003, the Journal of Alternative and Complimentary Medicine's Oct. 9th issue reported a study finding that Tai Chi "could decrease blood pressure and results in favorable lipid profile changes and improve subjects' anxiety status. Therefore, Tai Chi could be used as an alternative modality in treating patients with mild hypertension, with a promising economic effect." This study laid out a way to save our society; perhaps billions of dollars annually, and possibly save some patients with mild chronic hypertension the potential negative side effects of chronic lifelong medication. However, this largely hasn't occurred.

I caught a glimpse why when I was staying in the beautiful mountain town of Otavala, Ecuador, with a woman known for her knowledge of traditional Indian medicines. A tour of young American medical students stopped here to listen and learn from the Indian woman's tour of her herbal gardens. As I followed them, I asked a group of young bright medical students if they were aware that Tai Chi was found to reduce high blood pressure. One lovely young woman replied, "Oh, yes, I've heard that, but I would never prescribe it."

I asked why, and she responded that she couldn't because she didn't know if it would work. Although Tai Chi studies do show that Tai Chi indeed helps lower high blood pressure, it is true that it does not reduce it in every person. However, it is also true that every drug prescription does not work on every person either. I suggested to the young medical student that she consider that many times I've been to the doctor, and he's pulled out a prescription pad and explained, "Let's give this a try, and see how it works for you, and if it doesn't do the job, we'll try something else." Most of us are familiar with this, and by the confused look on the student's face, I'm assuming her memory banks were bringing up similar images.

So, why are our medical universities giving students the impression that they should not be prescribing Tai Chi, since we know it can help lower high blood pressure for many, who if it is successful with them, can enjoy a lifetime free of chronic and costly medications? And not only do that, but offer a plethora of GOOD SIDE EFFECTS including a stronger immune system and healthier respiratory system. This is a deep and important question we need to be asking as patients and consumers, and health professionals must begin asking this question regularly in order to fulfill the duties of their Hippocratic oath. For, today we have even a much better understanding of Tai Chi's potential than we did a few years ago, so ignorance or inconclusive data is not an acceptable explanation from our medical universities that train our future doctors, without teaching them about Tai Chi research, and what it portends for their future patients.

Today, we are clearer on exactly why Tai Chi is such a powerful therapy for high blood pressure sufferers. In a March 17, 2005, article by the Mayo Clinic staff posted at [mayoclinic.com](http://mayoclinic.com) they lay out what a "stress response" is, and the effects it has on the body. This is at the core of high

blood pressure problems and the physical changes chronic stress responses illicit that creates or aggravates hypertensive conditions.

In their article, they explain that a stress response, or "fight or flight" reaction involves our pituitary gland releasing adrenocorticotrophic hormone (ACTH), which sets a domino effect signaling other glands to produce additional hormones, such as adrenal glands which flood the blood stream with stress hormones, such as "cortisol" and "adrenaline."

When ordinary life's daily frustrations trigger this effect over and over again, the results can be damaging to the mind and body. Many of us experience this domino effect of triggers and hormones daily, which is why about 1/3 of Americans, or over 90 million Americans, suffer from high blood pressure.

Cutting edge scientists like Dr. Herbert Benson, President of the Mind/Body Institute at Beth Israel Deaconess Medical Center in Boston, are discovering a stunning reality through their research. In a wonderful article by Jeanie Lerche Davis at WebMD Medical News entitled The Mysterious 'Medication' of Meditation ([http://my.webmd.com/content/article/25/1728\\_57992.htm](http://my.webmd.com/content/article/25/1728_57992.htm)), she writes of how such researchers are discovering that "meditation can indeed be medication – creating long lasting physiological effects that reduce high blood pressure and even help unclog arteries to reverse heart disease."

Dr. Benson, who is also associate professor of medicine at Harvard Medical School, sought to prove how this effect could be shown objectively, and had five long-time meditation practitioners take MRI brain scans while meditating. Dr. Benson informed WebMD in the aforementioned article by Davis, "There was a striking quietude across the entire brain which was documented through MRI . . . The areas of the brain that became active from that quietude were those that control metabolism, heart rate, etc., . . . We knew meditation caused a relaxation response, but we couldn't prove it. We knew that if you thought in a certain way, with repetition, that physiologic changes would occur in the body. Here now is proof that mind, in the form of repetition, is affecting the brain, which affects the body . . ."

Stroke Magazine reported on a study funded by the National Institutes of Health, conducted by Dr. Amparo Castillo-Richmond, from the Maharishi University, more specifically on high blood pressure afflicting black people. The meditating group saw a reduction in the thickness of one of the arteries that supplied blood to the brain. Which indicates that blood flow is increasing. The group only using diet and exercise saw their artery walls getting thicker, which indicated that less blood was flowing through to the brain. This finding led Dr. Castillo-Richmond to make the profoundly exciting assertion, "It's possible to reverse heart disease through meditation." In fact, not only hypertension, but up to 90% of other illnesses sending us to the doctor are being caused by stress, according to Dr. Herbert Benson. Which makes Dr. Benson's and Dr. Castillo-Richmond's findings that meditative techniques can so dramatically alter our stress producing "fight or flight" response in healthy ways even more wonderful.

Dr. Benson explains, that the relaxation response triggered by repetitive forms [like tai chi, yoga, etc.] can result in decreased metabolism, heart rate, breathing rate, blood pressure, and also slower brain waves." Benson asserts that it is the repetitive nature of acts like praying the rosary, yoga, or tai chi's physical repetitive muscular actions that provides the profound hope for reducing anxiety, mild and moderate depression, anger and hostility, hypertension, cardiac irregularities, and all forms of pain, which are made worse by stress.

This concept of Tai Chi being an effective tool for reducing or even avoiding incidence of high blood pressure or other illnesses all together is echoed elsewhere. MayoClinic.com also recommends Tai Chi for relaxation training in an article entitled, "Relax: Techniques to help you

## Appendix C. Tai Chi handouts

achieve tranquility" which also explains why relaxation is important and what you might experience by practicing tools that will help you relax.

They detail how you can improve body responses to stress, such as: Slowing your heart rate; Reducing blood pressure; Slowing your breathing rate; Reducing the need for oxygen; Increasing blood flow to the major muscles; Lessening muscle tension.

They go on to explain that practicing relaxation techniques may help you experience: Fewer symptoms of illness, such as headaches, nausea, diarrhea and pain; Few emotional responses such as anger, crying, anxiety, apprehension and frustration; More energy; Improved concentration; Greater ability to handle problems; More efficiency in daily activities. So, time and time again as we begin to examine one particular benefit of Tai Chi, such as lowering high blood pressure, we see a whole universe of potential opening up before us.

An article from Archives of Internal Medicine, as reported on NBC's local WCAU Health ([http://wcau-tvhealth.ip2m.com/index.cfm?pt=ItemDetail&Item\\_ID=112735&Site\\_Cat\\_ID=77](http://wcau-tvhealth.ip2m.com/index.cfm?pt=ItemDetail&Item_ID=112735&Site_Cat_ID=77)) explained a Tai Chi research program at Tufts-New England Medical Center in Boston revealed a great deal. The article authors wrote, "Overall, these studies reported that long-term Tai Chi practice had favorable effects on the promotion of balance control, flexibility and cardiovascular fitness and reduced the risk of falls in elders . . . Cardiovascular and respiratory function improvements were noted in healthy people and those who had undergone coronary artery bypass surgery as well as people with heart failure, hypertension, acute myocardial infarction, arthritis and multiple sclerosis . . . Benefit was also found for balance, strength, and flexibility in older subjects; falls in frail elderly subjects; and pain, stress and anxiety in healthy subjects." - They add the actual ways that Tai Chi provides these benefits are not well known.

The fact is that less than .5% of the National Institute of Health's budget goes to research alternative therapies, leaving yoga, meditation, tai chi, massage, herbal therapy, aroma therapy, and the entire massive field of alternative health systems to struggle over .5%, or a little over \$100 million of the \$28 billion (approx.) annual budget. Given the above studies, it boggles the mind that such a small portion of the health research dollars are going to Tai Chi.

To recap, about 1/3 of the American population suffers high blood pressure. Tai Chi is proven to be a beneficial therapy that not only has no bad side effects, but dramatically improves immune function, respiratory function, lowers the incidence of anxiety and depression, and profoundly improves the balance of practitioners. Tai Chi does more, but for our purposes here these profound realities are enough to show exactly why it is truly unbelievable that Tai Chi is getting so little scrutiny in medical research dollars, when it can save so many from chronic suffering and perhaps some from a lifetime of chronic costly medications.

It is time we all began to ask the question that all good consumers should ask, "What is the best way/product for my health?" If Tai Chi is that product, the next question is, "Why isn't every physician offering it as an option to their patients with hypertension, as a prescription?" "Why aren't all insurance policies covering such prescriptions for Tai Chi?" Ask and ye shall receive. We must become informed and demanding health consumers, in order to get the best health options available.

This article does not advocate self-treatment, and encourages all to make health choices in conjunction with their physician. However, if your physician is close-minded to anything but a certain group of health options, even when research indicates your choices may be wider, than it is time to have a good talk with your physician about possibly widening your options.

BRUCE G. ROBINSON 021 155 4201

## Learn Natural Methods To Increase Melatonin Levels

### **Increase Melatonin through Meditation**

People who meditate have long known that this practice has positive health benefits that include improved energy and calmness of mind. Research now shows that meditation also increases levels of melatonin, an important hormone that supports the immune system, promotes deep and restful sleep, slows cell damage and aging, improves energy and may even inhibit the growth of cancer cells.

Melatonin is produced by the pineal gland of the brain. The philosopher Rene Descartes called this tiny gland "the seat of the soul". In the Hindu spiritual tradition, meditation techniques are used to direct energy flow through seven energy centers in the body, or chakras, and selectively activate or suppress their associated glands. The pineal gland corresponds to a chakra located at the top of the head and is believed to influence happiness.

The scientific connection between melatonin and meditation was first explored in 1995 by researchers at the University of Massachusetts Medical Center's Stress Reduction and Relaxation Program. Since melatonin is produced mainly at night, overnight urine samples were collected and tested for 6-sulphatoxymelatonin, a melatonin breakdown product considered to be an accurate reflection of blood melatonin levels.

Researchers found that women who meditated had significantly higher levels compared with women who did not.

A recent study published in the journal *Biological Psychology* confirmed this finding. The researchers found that meditation before bedtime increased melatonin levels for that night. No increases in blood melatonin levels were noted on nights where participants did not meditate. This suggests that regular practice of meditation is necessary.

## **How to Meditate**

Here is the meditation technique that was used in the research studies. For maximal benefit, try to meditate for twenty minutes to half an hour before you go to sleep.

## **Mindfulness**

1. Find a quite and comfortable place. Sit in a chair or on the floor with your head, neck and back straight but not stiff. Try to put aside all thoughts of the past and the future and stay in the present.

2. Become aware of your breathing, focusing on the sensation of air moving in and out of your body as you breathe. Feel your belly rise and fall, the air enter your nostrils and leave your mouth. Pay attention to the way each breath changes and is different.

3. Watch every thought come and go, whether it be a worry, fear, anxiety or hope. When thoughts come up in your mind, don't ignore or suppress them but simply note them, remain calm and use your breathing as an anchor.

4. If you find yourself getting carried away in your thoughts, observe where your mind went off to, without judging, and simply return to your breathing. Remember not to be hard on yourself if this happens.

5. As the time comes to a close, sit for a minute or two, becoming aware of where you are. Get up gradually.

## What is Qigong (Chi Kung)?

'Qi' or 'Chi' means energy. In Yoga, it is called 'Prana'. 'Gong' or 'Kung' means work. Therefore, Qigong means the exercise of your internal energy. It is a 5,000-year-old Chinese healthcare modality that has both endured the test of time and is making a tremendous resurgence at the threshold of the 21st Century. The benefits of Qigong are increasingly recognized for enhancing fitness in mind and body, developing vitality for sports and sex, and helping in the cure of stress as well as degenerative and chronic diseases. Literally millions practice Qigong in China and around the world each day to successfully treat diseases ranging from hypertension to cancer.

## Is Tai Chi Chuan (Taijiquan) a form of Qigong?

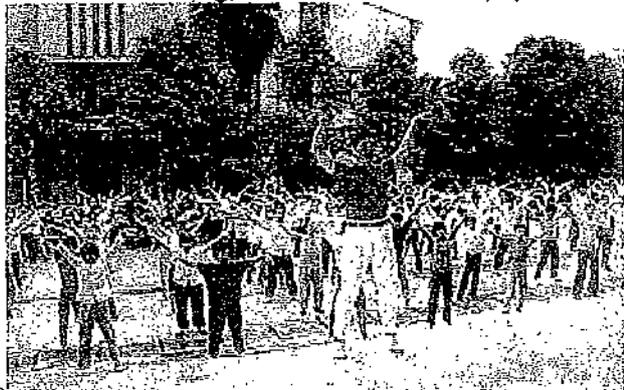
Tai Chi Chuan commonly known as Tai Chi is an internal martial art. However, the majority of Tai Chi practitioners just treat it as a slow dance. Without a solid Qigong foundation, it is just a slow and gentle exercise. At best, you just feel more relaxed and flexible by practicing it that way. Proper breathing and meditative techniques as well as the use of 'qi' are the keys to maximize the health benefits of Tai Chi.

People generally experience the health benefits when practicing Qigong faster than when they practice Tai Chi. Even the world famous Tai Chi grandmaster Feng Zhiqiang recommends that people practice Qigong instead of Tai Chi to gain health benefits if time is an issue. However, practicing Tai Chi and Qigong at the same time is most beneficial.

## Introduction to Tai Chi Qigong Shibashi

Whether you call it Taiji Chi Kung Shibashi (shibashi means 18 movements in Chinese), Taiji Qigong in 18 Movements or Eighteen Forms of Tai Chi Chi Kung, it is one of the most popular Qigong in the world.

Tai Chi Qigong Shibashi was developed by Professor Lin Hou-Sheng in 1979. Professor Lin is a renowned Qigong Master, scientist and Master Healer. His remarkable credentials include Professor of the College of Chinese Medicine in Shanghai, Director of Qigong Research Institute in China and Honorary President of the International Society of Natural Cures.



People practicing Tai Chi Qigong Shibashi in China



Master Lin is well known in China and has published more than ten books. In 1980 he developed a technique for successfully using Qigong as the only anesthesia needed in surgical operations: no anesthetics, no acupuncture needles just "qi" energy. His scientific studies on Qigong healing have been published in the prestigious journal Nature (Vol. 275, 1978). Master Lin has also personally given qigong healing treatments to high-ranking Chinese officials such as president Jiang Zemin.

Above: Master Lin demonstrates Shaolin kung fu

Tai Chi Qigong Shibashi is a Qigong which based on the philosophy of Tai Chi and extracts some of the best movements from the Yang style Tai Chi Chuan. It places emphasis on synchronizing the 18 movements with proper breathing techniques. It is a gentle, beautiful and flowing Qigong exercise routine that is both a joy to do and deeply relaxing.

Tai Chi Qigong Shibashi is designed to improve the general health and wellbeing of the practitioner. The gentle rocking motions and stretching movements improve circulation and digestion. The chest exercises and controlled breathing are good for lung conditions and asthma. And the overall effect of the exercise is to reduce mental stress and physical tension carried in the muscles of the body. This Qigong is very effective and easy to learn. It is practiced around the world by over 10 million people, and is considered a national health exercise in Malaysia and Indonesia.



Tens of thousands practicing Tai Chi Qigong Shibashi together at a stadium in Malaysia

### **Some benefits of Tai Chi Qigong Shibashi:**

- Improves Health
- Increases Energy, Agility and Flexibility
- Loosens and Strengthens Joints and Muscles
- Controls Weight
- Rejuvenates Body, Mind and Spirit
- Reduces Stress
- Improves Concentration and Intuitive Abilities
- Controls Emotions
- Easy to Learn

### **A Word from Sifu (Master) Wing Cheung**

"I have learned more than 30 different styles of Qigong. Tai Chi Qigong Shibashi is one of the most effective and easiest to learn. Most of my students are able to master it in just a few lessons. And many of them can feel the presence of 'Qi' traveling in their bodies after practicing for just 3 months.

## **How meditation can change your brain**

Sara Lazar, a neuroscientist at Massachusetts General Hospital and Harvard Medical School, was one of the first scientists to take anecdotal claims about the benefits of meditation and mindfulness and test them using brain scans. What she found surprised her – that meditating can literally change your brain.

Q: Why did you start looking at meditation and mindfulness and the brain?

A friend and I were training for the Boston Marathon. I had some running injuries, so I saw a physical therapist who told me to stop running and just stretch. So I started practising yoga as a form of physical therapy. I started realising that it was very powerful, that it had some real benefits, so I just got interested in how it worked.

The yoga teacher made all sorts of claims, that yoga would increase your compassion and open your heart. And I'd think, "Yeah, yeah, yeah, I'm here to stretch." But I started noticing that I was calmer. I was better able to handle more difficult situations. I was more compassionate and open-hearted, and able to see things from others' points of view.

I thought maybe it was just the placebo response. But then I did a literature search of the science and saw evidence that meditation had been associated with decreased stress, decreased depression, anxiety, pain and insomnia, an enhanced ability to pay attention, and an increased quality of life. At that point, I was doing my PhD in molecular biology. So I just switched and started doing this research as a postdoc.

Q: How did you do the research?

The first study looked at long-term meditators versus a control group. We found that long-term meditators have an increased amount of grey matter [compared with the non-meditating control group] in the insula and sensory regions, the auditory and sensory cortex, which makes sense. When you're mindful, you're paying attention to your breathing, to sounds, to the present moment experience, and shutting cognition down. It stands to reason your sense would be enhanced.

We also found they had more grey matter in the frontal cortex, which is associated with working memory and executive decision-making. It's well documented that our cortex shrinks as we get older: It's harder to figure

things out and remember things. But in this one region of the prefrontal cortex, 50-year-old meditators had the same amount of grey matter as 25 year olds.

So the first question was: Well, maybe the people with more grey matter in the study had more grey matter before they started meditating. So we did a second study. We took people who'd never meditated before and put one group through an eight-week programme of mindfulness-based stress reduction.

Q: What did you find?

We found differences in brain volume after eight weeks in five different regions in the brains of the two groups. In the group that learned meditation, we found thickening in four regions:

1. The primary difference we found in the posterior cingulate, which is involved in mind wandering and self-relevance.
2. The left hippocampus, which assists in learning, cognition, memory and emotional regulation.
3. The temporoparietal junction, or TPJ, which is associated with perspective-taking, empathy and compassion.
4. An area of the brain stem called the pons, where a lot of regulatory neurotransmitters are produced.

The amygdala – the fight-or-flight part of the brain which is important for anxiety, fear and stress in general – that area got smaller in the group that went through the mindfulness-based stress-reduction program. The change in the amygdala was also correlated to a reduction in stress levels.

Q: How long does someone have to meditate before they begin to see changes in their brain?

Our subjects took a weekly class. They were given a recording and told to practise 40 minutes a day at home. And that's it.

Q: So, 40 minutes a day?

Well, it was highly variable in the study. Some people practised 40 minutes pretty much every day. Some people practised 20. Some only a couple times a week. In my study, the average was 27 minutes a day. Or about a half-hour a day. There isn't good data yet about how much

someone needs to practice in order to benefit. Though there's absolutely no scientific basis to this . . . anecdotal comments from students suggest that 10 minutes a day could have some subjective benefit. We need to test it out.

We're just starting a study that will hopefully allow us to assess what the functional significance of these changes is. Studies by other scientists have shown that meditation can help enhance attention and emotion-regulation skills. But most were not neuroimaging studies. So now we're hoping to bring that behavioural and neuroimaging science together.

Q: Given what we know from the science, what would you encourage readers to do?

Mindfulness is just like exercise. It's a form of mental exercise, really. And just as exercise increases health, helps us handle stress better and promotes longevity, meditation purports to confer some of those same benefits.

But just like exercise, it can't cure everything. So the idea is it's useful as an adjunct therapy. It's not a standalone. It's been tried with many, many other disorders, and the results vary tremendously: It impacts some symptoms, but not all. The results are sometimes modest. And it doesn't work for everybody. It's still early days for trying to figure out what it can or can't do.

Q: So, knowing the limitations, what would you suggest?

It does seem to be beneficial for most people. The most important thing, if you're going to try it, is to find a good teacher. Because it's simple, but it's also complex. You have to understand what's going on in your mind. A good teacher is priceless.

Q: Do you meditate? And do you have a teacher?

Yes and yes.

Q: What's your own practice?

Highly variable. Some days, 40 minutes, some days, five minutes and some days not at all. It's a lot like exercise. Exercising three times a week is great. But if all you can do is just a little bit every day, that's a good thing, too. I'm sure if I practised more, I'd benefit more. I have no idea if I'm getting brain changes or not. It's just that this is what works for me right now.

## Alpha Waves - Alpha Brain Waves

Often when people ask, "What are Alpha Brain Waves?", they are really asking, "What are Alpha Brain Waves good for?", and "What do Alpha Brain Waves mean to me?" Answering the first question leads into the other two.

### What are Alpha Brain Waves?

**Alpha Brain Waves** are one of four **basic brain waves** [**Delta Waves**, **Theta Waves**, **Alpha Waves**, and **Beta Waves**] which make up the **EEG**, which is short for **electroencephalogram** and also **electroencephalograph**. The electroencephalograph is the recording device that produces the electroencephalogram. These 4 **brain waves** are all oscillating electrical voltages in the brain, but they are very tiny voltages, just a few millionths of a volt. The **Alpha brain waves** oscillate about 10 times per second, and the **range is 8-13 cycles per second**. The **brain waves** called "**Alpha**" were the first to be discovered (around 1908, by an Austrian Psychiatrist named **Hans Berger**). That is why they are called "**Alpha waves**", **Alpha brain waves** were discovered first. **Alpha** is the first letter of the Greek alphabet, like our "a".



**Dr. Hans Berger**  
Alpha brain wave pioneer  
Courtesy of  
**Biomagnetic Center, Jena**

Many hundreds of scientists have spent a lot of time studying these basic **brain waves** of the EEG, so there is a lot of basic knowledge about what **Alpha brain waves** are and what makes them appear and disappear in our brains. Yes, they appear and disappear. **Alpha brain waves** are not always present. For example, in deep sleep there are no **Alpha brain waves**, and if someone is very highly aroused as in fear or anger, again there are virtually no **Alpha brain waves**. **Delta brain waves** are seen only in the **deepest stages of sleep** (Stages 3 and 4). **Theta brain waves** are seen in **light sleep and drowsiness** (sleep stages 1 and 2). **Alpha brain waves** are seen in wakefulness where there is a **relaxed and effortless alertness**. **Beta brain waves** are seen in highly stressful situations, and where there is difficult **mental concentration and focus**.

**Delta waves** are the slowest oscillating **brain waves** (0-4 cycles per second). **Theta waves** oscillate somewhat faster (4-7 cycles per second). **Alpha waves** oscillate 8-13 times per second. **Beta waves** oscillate still faster (13-40 cycles per second). There are many other kinds of electrical activity in the brain, especially the short-lived evoked potentials that occur when the brain responds to sensory input (like a sound, or a touch, or a flash of light). However, the four basic EEG **brain waves**; **Delta waves**, **Theta waves**, **Alpha waves**, and **Beta waves** constitute the standard line-up of EEG brainwave activity.

### What are Alpha Brain Waves Good For?

The foregoing discussion makes the point that each of the four basic EEG **brain waves** is linked to a different state of consciousness. Each of the four types of **brain waves** (**Beta**, **Alpha**, **Theta**, **Delta**) is good for something different. However, we can get into trouble if we cannot turn on the type of brain wave needed for the task at hand. For example, if we cannot turn on **Theta brain waves** and **Delta brain waves**, we will suffer from insomnia, among

other things. On the other hand, people who can turn on the ideal **brain waves** to deal with each and every situation are considered gifted.

One useful metaphor compares the four basic **brain waves (Delta, Theta, Alpha, Beta)** with the **four gears on a car**. **Delta brain waves** (the slowest waves) are first gear. **Theta brain waves** are second gear. **Alpha brain waves** are third gear. **Beta brain waves** are fourth gear. No one gear is best for every driving situation, and no one **brain wave** is best for all of the challenges of life. We get into trouble if one of the gears on our car goes out, or if we forget to use some of the gears. For example if we drive our car starting in first gear, and then shifting directly into fourth gear (skipping second and third), we will have low gas mileage and high repair bills. The same is true of our brains. Sadly, **many people often skip their second and third brain gears (Theta and Alpha brain waves)**. The consequences of driving our brains in this manner are low productivity and high medical bills. How does this happen?

The way this occurs in everyday life can be illustrated by an example. People often wake up suddenly out of a deep sleep (**Delta brain waves**) with an alarm. Then they immediately feel stress and anxiety (**Beta brain waves**) about being late or being under time pressure. After insufficient sleep they pour caffeine down their throats to force themselves into (**Beta brain waves**) wakefulness, and the **caffeine** suppresses **Theta** and **Alpha brain waves**, while promoting **Beta brain waves**. All day they work under stress, pressure, and time urgency (**Beta, Beta, and more Beta**), until at night, they fall exhausted into deep sleep (**Delta brain waves**), having spent too little time unwinding, relaxing, and drowsing (which would have given them a bit more **Theta** and **Alpha brain waves**). Thus many people shift their brains suddenly and forcefully from **Delta** to **Beta**, and then back to **Delta**.

**Alpha brain wave** production is an innate skill of our brains, but one consequence of the modern stressful lifestyle is that we forget how to produce **Theta** and **Alpha brain waves**. Then we easily fall victim to anxiety and stress-related diseases. Anxiety and stress measurably reduce the strength of our immune systems. People who have more **Alpha brain waves** have less anxiety. Thus having **more Alpha waves** could mean **less anxiety and, correspondingly, stronger immune systems**, and this is good for everyone.

**Creativity** is another activity for which **Alpha brain waves** are helpful. Scientists have shown that highly creative people have different **brain waves** from normal and non-creative people. In order to have a **creative inspiration**, your brain needs to be able to generate a **big burst of Alpha brain waves**, mostly on the left side of the brain. The brains of creative people **can generate** these big **Alpha brain wave** bursts, and do so when they are faced with problems to solve. Normal and non-creative people do not produce **Alpha brainwave increases** when they are faced with problems, and so they can not come up with creative ideas and solutions. Any time you have an insight or an inspiration, you know your brain just produced more **Alpha waves** than usual. **Increased creativity** is helpful for everyone. One way to **increase creativity** is to increase **Alpha brain waves**.

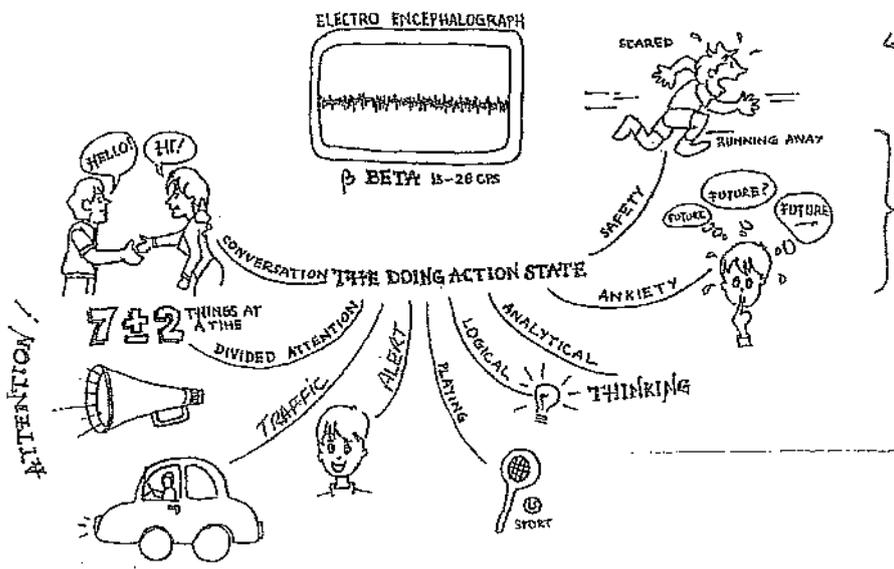
**Peak performance** is another activity for which **Alpha brain waves** are helpful. Recently sports scientists have shown that increases of **Alpha brain waves** (often in the left side of the brain) precede **peak performance**. One key difference between novice and elite athletes is in their **brain waves**. Just before their best free throws, an elite basketball player will produce a burst of **Alpha waves** on the left side of their brain. Just before their best strokes, elite golfers will produce a burst of **Alpha waves** in their left brain. Just before their best shots, elite

marksmen and archers will produce a burst of **Alpha waves** in their left brains. Novice and intermediate athletes do not show this **Alpha brain wave** pattern. However, one study of archers training over many weeks, showed that **as they improved their performance, they gradually increased the amount of left brain Alpha waves which occurred just before their best shots**. The **Alpha brain waves** seemed to be essential for **peak performance** and were increased, albeit slowly, by the archery training.

### **What Do Alpha Brain Waves Mean to Me?**

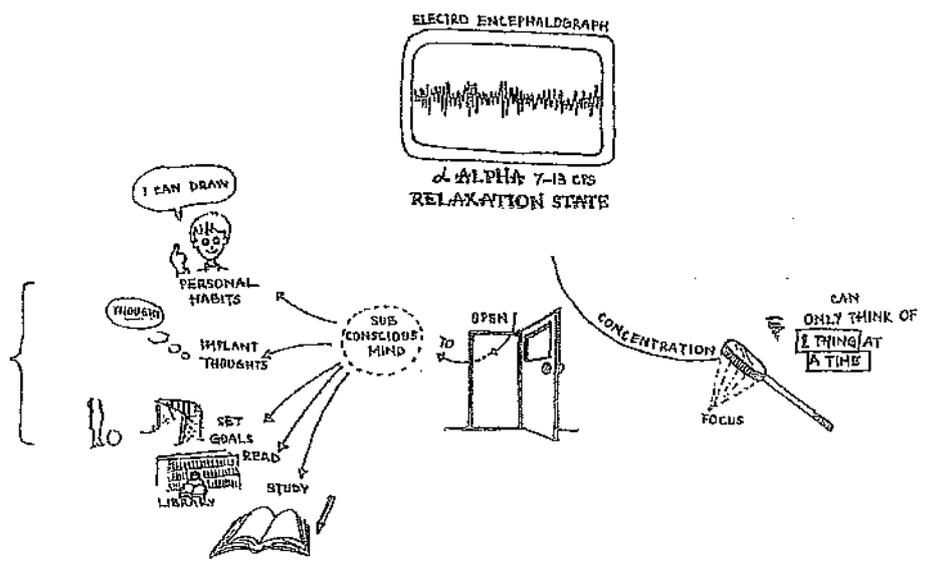
If you want to feel **less stress and anxiety**, you should increase the amount of your **Alpha brain waves**. This may also improve the **strength of your immune systems**, since stress weakens the **immune systems**. If you want to be **more creative**, you should learn how to increase the amount of your **Alpha brain waves**. If you want to have **more peak performance** in athletic activity, and in other areas of your life, you should learn how to **increase the amount of your Alpha brain waves**.

Appendix C. Tai Chi handouts



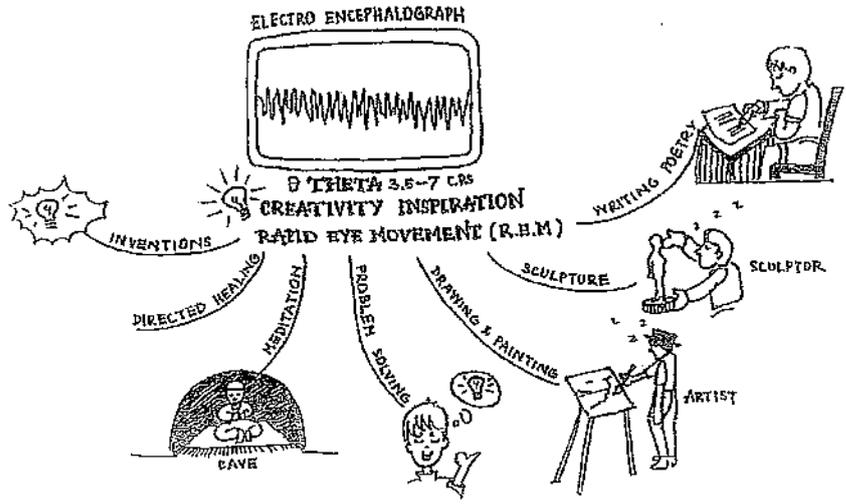
- DOING
- THINKING
- FEAR

- ALPHA →
- RELAXATION
  - ONE THING!



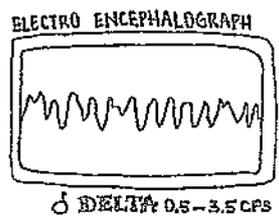
THETA

- INTUITION
- MEDITATION
- CREATIVITY

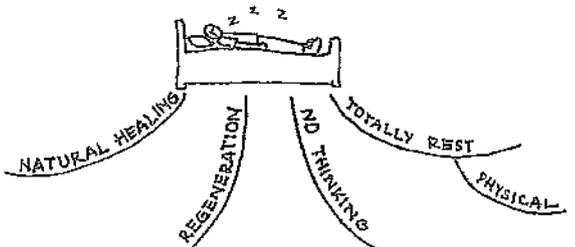


DELTA →

- SLEEP
- HEALING



THE DEEP DREAMLESS SLEEP



### What are meridians?

**In simple terms, a meridian carries energy as the artery carries blood.** It is the body's energy stream. It provides balance, strength, and assists metabolism. The flow of the meridian energy pathways is as critical as the flow of blood. The meridian system unifies all parts of the body and any obstruction or unregulated flow along the pathways can create disharmony with the connecting organ.

The meridian system consists of twelve key meridians with associated yin and yang organs. In nature, everything has both yin and yang. Yin is a more feminine, nourishing, cooling, and relaxing energy while yang is more masculine, active, warm, and consuming energy. Yin and yang is the basic foundation of Chinese medicine and is the reference for understanding the relationships of the body and the external environment.

### 12 Meridians of Our Organ System:

Lung Meridian - yin energy

Large Intestine Meridian - yang energy

Stomach Meridian - yang energy

Spleen Meridian – yin energy

Heart Meridian – yin energy

Small Intestine Meridian – yang energy

Bladder Meridian – yang energy

Kidney Meridian – yin energy

Pericardium Meridian -- yin energy

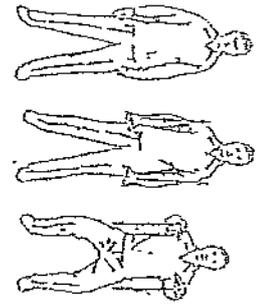
San Jiao Meridian – yang energy

Gall Bladder Meridian – yang energy

Liver Meridian – yin energy

The ancient Chinese medical model recognised that there is a surge or wavelike pattern along the meridians. The movement of this surge of energy follows a specific order, beginning with the lungs and ending with the liver over a 24-hour period.

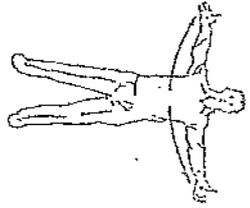
Although the flow of Qi within the pathways occurs several times in a day, there is a specific time when each organ meridian system has a 2-hour period of maximum activity. This occurs because there is a larger 24-hour cycle that influences the earth's Qi.



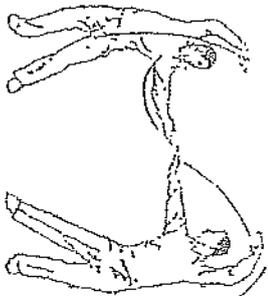
1. Regulating breathing



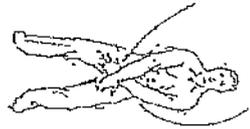
2. Expanding the heart



3. Dancing rainbow



4. Dividing the clouds



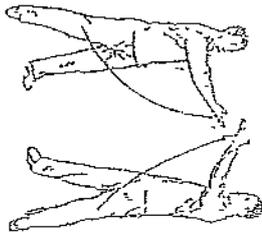
5. Swinging the upper arms



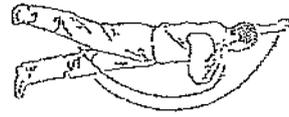
6. Rowing boat in the lake



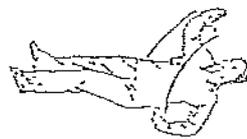
7. Pushing the waves to help bring in the tide



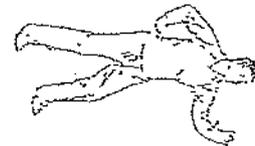
8. Holding up a ball in front of the shoulder



9. Turning to look at the moon



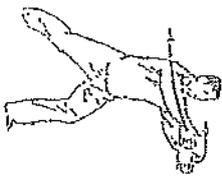
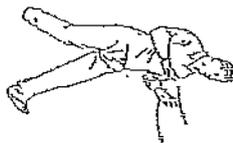
10. Twisting the wrist and cutting out with palm



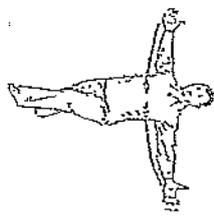
11. Sweeping arms while in horse-riding position



12. Scooping up from the sea and locking up at the sky



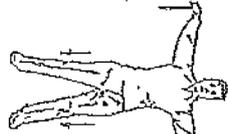
13. The flying pigeon spreads its wings



14. Punching with outstretched arm



15. The big goose flies



16. Stretching to stimulate a wheel in motion



17. Pressing with palms (at the end of exercise) to palms together.

太极气功十八式

TAIJI QI GONG IN 18 FORMS

Shanghai, China - 1980

## Appendix D. Q2 and Q3 responses

## Q2. What three words best describe how you are feeling?

## International Poi

52 relaxed	2 flexible	1 coming more naturally
30 challenged	2 floppy	1 completed
29 happy	2 funny	1 concentrate or relax
26 better	2 hard work	1 concentration or not
26 enjoying	2 hopeless	1 concerned
24 fun	2 I love poi	1 confident
20 frustrated	2 inspired	1 cool
20 tired	2 learning	1 cooperating
18 good	2 left please talk to the right	1 coordination not improving
18 progress	2 less uncoordinated	1 could I get there
18 uncoordinated	2 mobile	1 crash
18 improving	2 need more practice	1 curious
11 exercised	2 nice	1 determined
11 pleased	2 pleased I am taking part	1 different
8 calm	2 slowly improving	1 dizzy
8 stretched	2 sore shoulder	1 don't think too much
8 warm	2 stimulated	1 each lesson has challenges
7 confused	2 swinging	1 easier
7 great	2 tested	1 easier to get it right
7 loose	2 worked out	1 easy
7 more confident	1 achieved	1 energized
6 concentration	1 achieved my goal	1 energy flow
6 content	1 achieving more	1 engaged
6 interested	1 agile	1 enjoy stretches
6 satisfied	1 all at sea	1 enthused
5 getting there	1 all in the same boat	1 eureka! sort of
5 sore	1 amusing	1 excited
4 energised	1 an hour goes quickly	1 exhausted
4 relieved	1 aware	1 failed
4 stiff	1 awesome	1 fantastic
3 clumsy	1 baby steps	1 far from perfect
3 coordinated	1 back feels mobilised	1 feels good
3 getting it	1 battered	1 focused
3 hard	1 bendy	1 fresh
3 hopeful	1 brave	1 gaining confidence
3 hot	1 bringing movements back to mind	1 getting easier
3 invigorated	1 buzz when I get it	1 getting the idea
3 looking forward	1 can't do it	1 getting worse
3 surprised	1 caught the low sun	1 go man go
2 anxious	1 cheerful	1 good introduction
2 control	1 circle	1 good session
2 delighted	1 cleverer	1 gorgeous
2 elated	1 clunk	1 got it
2 exhilarated	1 collapsing	1 got it sort of
2 fine		1 got one I didn't have before

1 gotta beat this	1 sad final class
1 got there	1 settled
1 greater understanding of coordination issues	1 slow
1 great tutor	1 small progress
1 grrrrr	1 smoother
1 grumpy	1 some rhythm coming
1 harder than you think	1 sore back
1 haven't got it	1 split time split brain
1 headache gone	1 sticking
1 helping my shoulder	1 still learning
1 impatient	1 stretchy
1 inadequate	1 struggling
1 inept	1 stumbled today
1 intricate	1 sway
1 intrigued	1 sweaty
1 irritated	1 sweet
1 keen	1 switching sides
1 kind of did it	1 tall
1 left right	1 thanks
1 less frustrated	1 to battle on
1 less stressed	1 torture
1 lethargic	1 tough
1 long way to go	1 trying not succeeding
1 lot to learn	1 trying not to overthink
1 made it to the end	1 turn
1 memory coming	1 twisted limbs
1 mixed up	1 twisted mind
1 more comfortable	1 uneven
1 more coordinated	1 unfocused
1 most uncoordinated day	1 very nice
1 must try harder	1 weary
1 noise	1 well
1 not going backwards	1 well paced classes
1 ok confidence	1 will take more than a month
1 optimistic	1 wonderful
1 peaceful	1 wonderful to move
1 pendulums	1 work to be done
1 penny drops	1 worn
1 performing	1 worse
1 persevere	
1 persist	
1 poi is great	
1 pooped	
1 practice	
1 programming	
1 puffed	
1 ready	
1 refreshed	
1 relaxation is key	
1 relax the neck	
1 renewed	
1 rhythm coming	

## Tai Chi

117 relaxed	2 composed	1 clarity
112 calm	2 cool	1 clearer
38 peaceful	2 curious	1 clear eyed
26 energised	2 ease	1 clear headed
18 focused	2 engaged	1 clear minded
17 slow	2 enthralled	1 cluttered
16 happy	2 excited	1 concerned
16 warm	2 floating	1 contradictions in my feelings
14 aware	2 heavy	1 cool stuff
14 tired	2 informative	1 coordinated
11 hot	2 intrigued	1 creaky shoulder
10 interested	2 invigorated	1 deep
10 quiet	2 loose	1 de-stressed
9 inspired	2 uncoordinated	1 dissatisfied
8 balanced	2 open	1 distracted
8 good	2 pleasant	1 empty
7 better balance	2 positive	1 enervated
7 grateful	2 practice	1 enjoyed all classes
7 satisfied	2 safe	1 entranced
7 stretched	2 self aware	1 exercises more familiar
6 comfortable	2 smiling	1 extended
6 sleepy	2 smooth	1 fascinated
6 thoughtful	2 soft	1 feel good at the end
5 better	2 soothed	1 feelings
5 breathing	2 sweaty	1 fingers tingling
5 challenged	2 tingling	1 flow
5 learning	2 tranquil	1 fluid
5 pleased	2 upright	1 focus
5 present	1 accepting	1 focusing easier
5 refreshed	1 alive	1 focus on form
5 sore	1 ankles weak	1 following instructions
5 still	1 annoyed	1 form
4 centered	1 anticipatory	1 forward back
4 confused	1 anxious	1 free
4 content	1 appreciative	1 friendly
4 enlightened	1 at ease	1 frustrated
4 gentle	1 at peace	1 full
3 breathless	1 aware of movements	1 fuzzy
3 concentrating	1 awkward	1 gear change
3 enjoying	1 benefited	1 getting the idea
3 grounded	1 better control	1 getting to know effects
3 light	1 better than before	1 got a few
3 next	1 better timing	1 got the big arm circles yay
3 released	1 breathing easier	1 graceful
3 stiff	1 bumpy	1 great
2 achy	1 buzz in back of head	1 hand joints
2 alert	1 cannot balance	1 headachey
2 awake	1 carefree	1 head full of chatter quiet now
2 better concentration	1 challenging to follow	1 healed
2 buzzy	1 circles	1 heavy arms

## Appendix D. Q2 and Q3 responses

1 heavy breathing	1 settled
1 heavy lidded	1 silent
1 hopeful	1 simple feelings like healing
1 hungry	1 slightly clearer
1 hypnotized	1 solid
1 impatient	1 stance
1 in awe	1 steady
1 informed	1 still alive
1 in the moment	1 still need to follow
1 involved	1 stimulated
1 joyous	1 stronger legs
1 keen to pursue	1 supple
1 learning about relationship to health	1 surprised
1 learning lots need to put into action	1 thanks bruno
1 learning to breathe	1 think different
1 less stressed	1 thinking less
1 lighter	1 thinking quiet
1 like the theory	1 tight muscles
1 looking forward to more	1 time goes fast
1 love the philosophy	1 timing
1 lyrical	1 tingly
1 mind calmer	1 tingly fingers and head
1 mind clear	1 tipsy
1 mindful	1 trouble concentrating
1 more flexible	1 trouble coordinating
1 more in balance	1 trouble with coordination and breathing
1 more in the zone	1 trying
1 motivated	1 unbalanced
1 musical	1 understanding better
1 new understanding	1 unsteady
1 no answer	1 up down
1 non stressed	1 uplifting
1 nostalgic	1 useful
1 not so exhausted	1 useless at balancing
1 not so sweaty	1 warmed inside
1 not sure	1 weak legs
1 now	1 well
1 persistence	1 wobbly knees
1 rain washing	1 wondering
1 ready	1 worried
1 ready for anything	1 wrapped
1 ready to face the day	1 zingy
1 realizing	
1 respectful	
1 rested	
1 restful	
1 rhythm	
1 rushing to think	
1 sad last class	
1 sceptical	
1 serene	

**Q3. Question 2:** Did you experience any negative effects which seemed to be caused by practicing poi/Tai Chi? If so, please explain.

**Q3. Question 3:** Did you experience any positive effects which seemed to be caused by practicing poi/Tai Chi? If so, please explain.

**Q3. Question 4:** Is there anything else you would like to share about your experience?

Poi	
Physical (positive)	<p>Flexibility/looseness</p> <ul style="list-style-type: none"> <li>● Positive on flexibility</li> <li>● I think it has been helpful for my arthritic wrists.</li> <li>● Able to use my left wrist more freely.</li> <li>● Probably felt better due to the activity of stretching differently.</li> <li>● More flexible in shoulders.</li> <li>● Wrists have loosened up and shoulders have relaxed</li> <li>● I suffer from torn tendons on both shoulders and arthritis in my neck. Doing poi seems to loosen up the stiffness in my back, shoulders, and neck.</li> <li>● I think I have less soreness and more flexibility. I think my flexibility in my wrist has improved.</li> </ul> <p>Handedness</p> <ul style="list-style-type: none"> <li>● I became aware of my right handedness.</li> <li>● Made me more aware of using my left hand - i.e. now try to do more with my left hand like making a coffee, opening fridge door.</li> <li>● Positive effect is that I realised my inability to use my left hand and I shall now work on that in other aspects of my everyday life.</li> <li>● It made me aware: how difficult it is to have my left hand and my right hand do different things. My left arm not nearly as easy to control or get to follow instructions as my right. Clumsy with my left arm / hand.</li> <li>● Amusing to see that one hand is not always the dominant one. Either can take charge.</li> <li>● Learning about my lack of coordination, L and R, need to work on my L.</li> <li>● I have gained strength and direction in my left hand and arm which I noticed when sawing through a heavy tree branch.</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● My shaking hand definitely improved.</li> <li>● Possibly less likelihood of tired shoulders at the end of the day. Sleeping well.</li> </ul>

	<ul style="list-style-type: none"> <li>● Upper arms firming up.</li> <li>● Positive on stress release and even thought weight loss. And I'd have thought muscle tone?</li> <li>● I was reminded about "good posture" which I forget.</li> <li>● Also I think spinning poi is improving my peripheral vision and balance.</li> </ul> <p>Relaxation</p> <ul style="list-style-type: none"> <li>● Relaxation - even though I am concentrating on what i am trying to achieve with each move, I find it quite relaxing.</li> <li>● Relaxed and fun environment.</li> <li>● Generally relaxed after a lesson.</li> <li>● Feel relaxed and stretched!</li> <li>● Relaxing.</li> <li>● I find picking up my poi at home fun and relaxing.</li> </ul> <p>Coordination</p> <ul style="list-style-type: none"> <li>● Improvement of coordination.</li> <li>● I am positive that my coordination has improved since starting, although sometimes not as good as I would like, but to keep doing poi would continue the improvement.</li> <li>● Realization at coordination loss as part of the ageing progress. Poi is a gentle way at regaining some more coordination as well as exercising in a rotational manner.</li> <li>● Helpful for coordination.</li> <li>● Pleasure in practicing coordination exercises.</li> </ul> <p>Good exercise</p> <ul style="list-style-type: none"> <li>● I did get hot and perspired which I assume shows I was working out well!</li> <li>● I love using my body for gentle exercise and this was an excellent class to do so.</li> <li>● Good exercise, good to feel the muscles working.</li> <li>● Great form of exercise.</li> </ul>
<p>Physical (negative)</p>	<p>Sore/stiff/pain</p> <ul style="list-style-type: none"> <li>● No ill effect. One day was followed by a small amount of muscle stiffness but I had been holding my arms with a lot of tension</li> <li>● Sore wrists after first class, then nothing after that</li> <li>● Some lower back ache - wondered whether I was moving or not moving properly.</li> <li>● 2nd or 3rd session in I had a very sore neck and shoulders and when I saw a photo of the session I realized I was so tense in the area mentioned. My Pilates teacher also said it was so important to relax my neck and shoulders. So I have made a very conscious effort to relax in that region. Fine ever since.</li> <li>● Minor discomfort in my wrists after two lessons.</li> </ul>

	<ul style="list-style-type: none"> <li>● Had a little pain in my left hand initially, but it is ok now.</li> <li>● Not [indecipherable] but had groin soreness which I was told caused by twisting. The only change to normal routine was poi + chasing the sun. Seemed to alleviate when that movement was not done. Otherwise all good.</li> <li>● A little shoulder soreness during the session</li> <li>● Left shoulder cuff: soreness from previous injury</li> <li>● I have to be careful not to lift my arms too high as the arm movements can aggravate my shoulder problem.</li> <li>● slight tendonitis in my left arm / elbow</li> <li>● slightly achy</li> <li>● Yes I had a slightly sore right shoulder after one session</li> </ul> <p>Tiring</p> <ul style="list-style-type: none"> <li>● No pain, sometimes tired and sometimes annoyed at myself.</li> <li>● Legs and sometimes back tired.</li> <li>● At first, my arms were tired after the 2nd session. But this went away with further sessions.</li> <li>● Initial tired arms which lasted no more than minutes.</li> <li>● Not directly but I do find it difficult to stand for a long time.</li> </ul>
<p>Emotional (positive)</p>	<p>Fun/enjoyment</p> <ul style="list-style-type: none"> <li>● A stimulating experience. I feel lucky to have participated in a new form of exercise.</li> <li>● Motivation to improve. Pleased when I got it right.</li> <li>● Fun class so leave feeling good.</li> <li>● Felt good about coming and enjoyed it during a stressful house moving time. Enjoyed the whole experience.</li> <li>● Felt positive overall after the lessons.</li> <li>● Have enjoyed being part of the group.</li> <li>● I felt I had something new, fun, and interesting to do</li> <li>● Fun</li> <li>● Very fun and enjoyable.</li> <li>● Enjoyable group activity.</li> <li>● Totally, totally positive. Mental and physical</li> <li>● I find picking up my poi at home fun and relaxing. I get a sense of enjoyment from swinging my poi and the need to focus and concentrate has been a bonus.</li> </ul> <p>Instructor relationship</p> <ul style="list-style-type: none"> <li>● Working with kate has been a joy.</li> <li>● Meeting and getting to know Kate and her work has been an absolutely delightful experience right from our first email in 2015 to the classes and tests.</li> <li>● The non-threatening environment promoted by Kate is extremely important.</li> </ul>

	<ul style="list-style-type: none"> <li>● Rewarding to be encouraged by our lovely teacher</li> <li>● Kate is also a great leader, her passion for poi is infectious. Very fun and enjoyable.</li> <li>● Great teacher!</li> <li>● Lovely guide!</li> <li>● The tests, their integration and the positive intent of the course (and especially its leader).</li> </ul> <p>Want to continue</p> <ul style="list-style-type: none"> <li>● I have enjoyed participating in the class, would like to continue.</li> <li>● A great exercise and I hope to continue with this.</li> <li>● A rewarding feeling to achieve the following week what seemed impossible the week before! A stimulating experience. I feel lucky to have participated in a new form of exercise. I'd very much like to keep going.</li> <li>● Wish I could do more.</li> <li>● Love to take it to the next level...fire or laser poi?</li> <li>● I appreciate the opportunity to learn poi and will continue to practice when the classes have finished.</li> </ul> <p>Achievement</p> <ul style="list-style-type: none"> <li>● It is frustrating at times but also gives a sense of achievement and exhilaration.</li> <li>● There is a sense of achievement.</li> <li>● Felt sense of achievement.</li> <li>● I have a sense of accomplishment.</li> <li>● A little bit of stress trying to get it right, but a sense of joy when achieved.</li> <li>● The feeling of achievement when I didn't smash the poi into my face.</li> </ul> <p>Being in a group</p> <ul style="list-style-type: none"> <li>● Knowing that we are all similar in our way of thinking about ageing.</li> <li>● Have enjoyed being part of the group.</li> <li>● Enjoyable group activity</li> <li>● Have not been part of a learning group apart from a classroom and have found the experience most enjoyable, even when the poi don't do what I want them to</li> <li>● Being with a similar age group. Having a commitment to stick to.</li> </ul> <p>Calm/peace</p> <ul style="list-style-type: none"> <li>● There is quite an element of peacefulness about the experience of doing poi in synch.</li> <li>● Increasing calmness in activity</li> <li>● Almost like a meditation.</li> </ul>
Emotional	Frustration

<p>(negative)</p>	<ul style="list-style-type: none"> <li>● Also had a lot of frustration when I realized my incompetence using the left hand. I had thought my coordination would have been better. That was a bit stressful at the beginning!</li> <li>● Only negative effect was frustration at lack of real proficiency.</li> <li>● No pain, just a sense of frustration of not being able to master something new which looked to simple.</li> <li>● I have felt frustrated by the lack of coordination of the brain versus body but it's interesting to explore that.</li> <li>● It is frustrating at times but also gives a sense of achievement and exhilaration.</li> </ul> <p>Other</p> <ul style="list-style-type: none"> <li>● Also felt very uncoordinated and worried whether that would pass - it did.</li> <li>● A little bit of stress trying to get it right, but a sense of joy when achieved.</li> <li>● No pain, sometimes tired and sometimes annoyed at myself.</li> </ul>
<p>Cognitive (positive)</p>	<p>Learning a new/different skill</p> <ul style="list-style-type: none"> <li>● I felt good learning a new skill. It was challenging and I did feel myself improving in some moves which I thought I could never ever be able to do. The teaching by Kate, sometimes analysed by her, helped me see the steps to these intricate moves. It was an exciting experience.</li> <li>● Learning something new at this stage - age ie - has been a very good experience for me.</li> <li>● Made me realize important to try new things even if not easy!</li> <li>● Satisfaction from learning a new skill.</li> <li>● Great form of exercise, am enjoying learning a new skill.</li> <li>● Feel pleased to tackle something new and learn new skills.</li> <li>● Learning to age in a positive way. A great exercise and I hope to continue with this.</li> <li>● Yes a sense of something new to experience. A new experience is always good for the soul and personal achievement</li> <li>● Nice to do something different and be entertained!</li> <li>● A good experience, different.</li> <li>● I felt I had something new and interesting to do.</li> <li>● Learning poi with Kate has given me the confidence to try and learn to do something different which I haven't done for too many years, and have not been part of a learning group apart from a classroom and have found the experience most enjoyable, even when the poi don't do what I want them to</li> <li>● The challenge of learning a new skill.</li> </ul> <p>Focus/concentration</p> <ul style="list-style-type: none"> <li>● Focus and concentration. Left side skills catching up on right hand (right handed!)</li> </ul>

	<ul style="list-style-type: none"> <li>● Learning to concentrate more. Focusing better.</li> <li>● Improved concentration.</li> <li>● I get a sense of enjoyment from swinging my poi and the need to focus and concentrate has been a bonus.</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● I feel that my memory has improved and possibly multitasking as well.</li> <li>● Doing poi I found cleared my head space. A very positive thing.</li> <li>● Very beneficial left and right brain practice</li> </ul> <p>Challenge</p> <ul style="list-style-type: none"> <li>● Enjoyed the challenge</li> <li>● It was challenging and I did feel myself improving in some moves which I thought I could never ever be able to do.</li> <li>● Challenging.</li> </ul> <p>Brain/body connection</p> <ul style="list-style-type: none"> <li>● Must surely be good for my brain with the split time movements and crossing the midline.</li> <li>● It is a connective experience of brain and body to coordinate which is beneficial.</li> <li>● It is a very interesting experience to do a practice, something completely different, which engages your body / brain coordination</li> </ul> <p>More alert</p> <ul style="list-style-type: none"> <li>● Brain was more alert for a few hours afterwards</li> <li>● Yes I certainly feel more alert and confident in my brain power. I say to myself “now I am a clever brainy person”</li> </ul>
Cognitive (negative)	none

Tai Chi	
Physical (positive)	<p>Relaxed</p> <ul style="list-style-type: none"> <li>● Always felt relaxed after it no matter what, even though stressors may have occurred before it.</li> <li>● Overall exercising, relaxation, calmness of mind.</li> <li>● Breathing and relaxation more often.</li> <li>● I feel really relaxed and pleasantly stimulated after each session.</li> <li>● Feel calm and sense of relaxed feeling improve in quality and duration</li> <li>● Calmness, focus, relaxation.</li> </ul>

	<ul style="list-style-type: none"> <li>● I find Tai Chi both relaxing and working the body and mind makes me more aware of negative thoughts outside of class.</li> <li>● More relaxed and more at peace.</li> </ul> <p>Balance</p> <ul style="list-style-type: none"> <li>● My balance is improving.</li> <li>● I have definitely improved my ability to balance on one leg!</li> <li>● My balanced has slightly improved</li> <li>● Balance possibly a little better. I enjoyed it.</li> <li>● Balance appears better.</li> <li>● My balance has improved.</li> <li>● balance has improved.</li> </ul> <p>Sleep</p> <ul style="list-style-type: none"> <li>● Sleeping has been better.</li> <li>● Sleeping better.</li> <li>● Sleeping much better - I used to wake often during the night. Wake feeling fresher.</li> <li>● After 10 minutes Tai Chi before bed, I sleep better - getting off to sleep is easier</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● My digestion has improved</li> <li>● Tai Chi is the new aerobics for me.</li> <li>● Core stronger</li> <li>● Lightness during day, be aware, skipping over annoyances.</li> <li>● I try to do some between classes and there's a gradual loosening of joints, etc</li> <li>● Flexibility better. Core stronger.</li> </ul> <p>Reduce Pain</p> <ul style="list-style-type: none"> <li>● I usually arrive with a very stiff neck, after Tai Chi it is gone and the relief lasts all day.</li> <li>● Releasing tension in shoulders.</li> <li>● The niggling pain in my right gluteus has gone.</li> <li>● Fewer Aches and pains in joints - almost none. A general sense of wellbeing.</li> </ul> <p>Breathing</p> <ul style="list-style-type: none"> <li>● Calmed respiratory discomfort, surprisingly, while doing exercises</li> <li>● Conscious of breathing.</li> <li>● More aware of breathing</li> <li>● Breathing and relaxation more often.</li> </ul> <p>Exercise</p> <ul style="list-style-type: none"> <li>● This experience has motivated me to exercise more in general</li> </ul>
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	<ul style="list-style-type: none"> <li>● Overall exercising</li> <li>● This level of exercise suits me well as a person who hates any kind of competitive exercise, I can see myself keeping it up.</li> <li>● I can do the exercises! I am currently on a diet and this exercise regime and my rowing really helps.</li> </ul> <p>Wellbeing</p> <ul style="list-style-type: none"> <li>● General sense of wellbeing</li> <li>● A good insight to general wellbeing</li> </ul> <p>Posture</p> <ul style="list-style-type: none"> <li>● More aware of posture, applying the above to day to day activities, not all the time though!</li> <li>● Posture is improved - more aware of posture especially leaving class.</li> </ul>
<p>Physical (negative)</p>	<p>Sore/stiff/pain</p> <ul style="list-style-type: none"> <li>● A little joint and muscle soreness but nothing worrying.</li> <li>● My arms felt a bit stiff sometimes but not too bad.</li> <li>● Some muscle or joint soreness in my shoulders, but figured the joint has not been doing much in my 'normal' life</li> <li>● Muscle and joint soreness, probably more to do with my inflammation than the Tai Chi</li> <li>● previous pain remained but did not increase.</li> <li>● Pain in lower back, but suffer that already.</li> <li>● Ankle pain - stress</li> <li>● Could feel old shoulder injury as I reached up</li> <li>● Just a few twinges - I'm carrying injuries but they coped and so did I</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● [indecipherable] over whether it may be beneficial or harmful to torn ligaments in my knees which were identified years ago but are no longer an issue. No treatment was given.</li> <li>● Interesting noticing different feelings on different sides and directions</li> <li>● Sometimes felt nauseous by the time we had finished</li> </ul>
<p>Emotional (positive)</p>	<p>Peace/calm</p> <ul style="list-style-type: none"> <li>● More relaxed and more at peace. More able to let things go than I was. Already better able to cope with work stresses.</li> <li>● Maybe a bit calmer.</li> <li>● Definitely more peaceful and thoughtful.</li> <li>● Overall exercising, relaxation, calmness of mind</li> <li>● Think i've been calmer in general and a little stress and grumpy at work</li> <li>● Peace easier to achieve.</li> <li>● Calmness. This has influenced my life a bit too, I try to do breathing awareness thing.</li> </ul>

	<ul style="list-style-type: none"> <li>● I feel real calm and peace during and after each session, sometimes I can enter this space in my between session life, but not as much as I would like yet (there goes my yang!).</li> <li>● I definitely felt calmer after my Tai Chi lessons, I almost feel as though I have a different outlook on life. I can tell when I and other people are stressed.</li> <li>● Calmness, awareness. A good insight to general wellbeing</li> <li>● Much calmer and more focused.</li> <li>● The positive came about from the calming effects of the class</li> <li>● Calmer for a short while - then back to usual</li> <li>● The peace and calm</li> <li>● Feel calm and sense of relaxed feeling improve in quality and duration</li> <li>● Calmness, focus, relaxation.</li> <li>● Experiencing more mindfulness and keeping calmer in awkward situations</li> </ul> <p>Instructor relationship</p> <ul style="list-style-type: none"> <li>● Bruno's lovely warm smile.</li> <li>● Bruno is a very pleasant instructor.</li> <li>● Bruno, the teacher, is extremely good at understanding his patients and being patient with his teachings.</li> <li>● Bruno = a very clear communicator and competent exponent.</li> <li>● I have really enjoyed both the exercises themselves and Bruno's quiet, calm and reassuring teaching style. Thanks to all involved.</li> <li>● Bruno is a great Tai Chi teacher.</li> <li>● Bruno was the perfect instructor - non-judgemental so didn't feel foolish if not doing moves correctly.</li> <li>● I had tried a few lessons in tai Chi previously but had never enjoyed them to the extent I've enjoyed Bruno's.</li> <li>● Bruno is excellent.</li> </ul> <p>Enjoyment</p> <ul style="list-style-type: none"> <li>● I'm really enjoying doing Tai Chi and want to improve.</li> <li>● Very enjoyable to learn. Never too late but wish I had started earlier.</li> <li>● Enjoying the journey, enjoying the talks.</li> <li>● A thoroughly enjoyable experience.</li> <li>● It was a good experience which I look forward to each week.</li> <li>● I have really enjoyed both the exercises themselves and Bruno's quiet, calm and reassuring teaching style. Thanks to all involved.</li> <li>● I had tried a few lessons in tai Chi previously but had never enjoyed them to the extent I've enjoyed Bruno's.</li> <li>● I very much look forward to my Tai Chi lessons.</li> </ul> <p>Stress</p> <ul style="list-style-type: none"> <li>● More able to let things go than I was. Already better able to cope with work stresses</li> </ul>
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	<ul style="list-style-type: none"> <li>● Quite a few - stress reduction, control over mind and movement of limbs for various movement. It is easier to do many movements.</li> <li>● Lightness during day, be aware, skipping over annoyances.</li> </ul> <p>Want to continue</p> <ul style="list-style-type: none"> <li>● Initially I was totally unsure of what to expect and what would be involved. I was skeptical. however as the test goes on I have been very impressed. Am looking forward to doing further Tai Chi.</li> <li>● Definitely want to find a class to continue on doing it when this experiment ends.</li> <li>● I am really valuing this and I hope to make it a part of my life!</li> </ul> <p>Want to share</p> <ul style="list-style-type: none"> <li>● I am keen to share my positive Tai Chi experience with friends and family as I think practicing Tai Chi can benefit everyone.</li> <li>● I tell everyone I meet about how excellent I am about doing Tai Chi.</li> <li>● I would like many more people try this and gain the benefit, particularly for people who are stressed and rigid with their body.</li> <li>● Would recommend Tai Chi to “grown ups” long term</li> </ul> <p>Being part of a group</p> <ul style="list-style-type: none"> <li>● Just the experience of being in a similar age group of people all experiencing a new thing in their lives and enjoying the enthusiasm and commitment.</li> <li>● Met some very pleasant folks to chat with.</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● Reminded to try to be centered - to come back to core when distracted. Tai Chi is something that can be of value to all.</li> <li>● Yes, it’s good to be in my body! I spend far too much time in my head, responding to others and predicting the future. I do want to be here now.</li> </ul>
<p>Emotional (negative)</p>	<p>No category</p> <ul style="list-style-type: none"> <li>● Stress was in straining to hear what Bruno says. Better with hearing aids, but still a strain</li> </ul>
<p>Cognitive (positive)</p>	<p>Mindfulness/awareness</p> <ul style="list-style-type: none"> <li>● I find tai chi both relaxing and working the body and mind makes me more aware of negative thoughts outside of class.</li> <li>● Experiencing more mindfulness and keeping calmer in awkward situations</li> <li>● Calmness, awareness.</li> <li>● It soothes the crazy mind (beta waves!).</li> <li>● Mind a bit clearer.</li> <li>● As with meditative (and lots of other things) we can learn to still our</li> </ul>

	<p>minds and learn to act deliberately.</p> <ul style="list-style-type: none"> <li>● Definitely more peaceful and thoughtful.</li> <li>● Calmness of mind</li> </ul> <p>Slowing down</p> <ul style="list-style-type: none"> <li>● Slowing down more frequently. Small gear change in thinking.</li> <li>● More aware of slowing down my reactions, ie “letting go.”</li> <li>● I appreciate regular schedules to slow down and focus.</li> <li>● Slowed down a little</li> <li>● Calming, slow my mind,</li> <li>● Slowing up movements (yin), concentration and focus during exercise, breathing and relaxation more often.</li> <li>● As with meditative (and lots of other things ) we can learn to still our minds and learn to act deliberately.</li> </ul> <p>Theory</p> <ul style="list-style-type: none"> <li>● Interest in the theory.</li> <li>● I am enjoying the learning experience, ie why and what the movements are set to achieve</li> <li>● It’s great! I can see a lot of benefit in it. Also when I go swimming at olympic pool I can appreciate how the Chinese people are always moving their joints. This led to a little cultural awareness.</li> <li>● Liked the connectedness explained with people and planet. Well worth the experience and can understand how wellbeing must benefit from such exercise.</li> <li>● I almost feel as though I have a different outlook on life. I can tell when I and other people are stressed.</li> </ul> <p>Concentration/focus</p> <ul style="list-style-type: none"> <li>● Slowing up movements (yin), concentration and focus during exercise, breathing and relaxation more often.</li> <li>● I concentrate better.</li> <li>● Much calmer and more focused.</li> <li>● Calmness, focus, relaxation.</li> </ul> <p>No category</p> <ul style="list-style-type: none"> <li>● Quietness</li> <li>● Given me thought as to how I am doing with my time and problems. Trying to put into practice what I feel can help me.</li> <li>● Control over mind and movement of limbs for various movement. It is easier to do many movements</li> </ul>
<p>Cognitive (negative)</p>	<p>No category</p> <ul style="list-style-type: none"> <li>● Yes but only in the last session and afterwards. It was as if my body / mind had split. The mind wanted me to quit and do something purposeful! I [indecipherable] that experience and came back more</li> </ul>

	<p>positively.</p> <ul style="list-style-type: none"><li>● It was hard to concentrate or slow down initially, over time improved.</li></ul>
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