# D3.2.1
# Sensorimotor Diagnostics

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| **Work package** | **WP3 MULTIMODAL ANALYTICS & ASSESSMENT** |
| **Task** | **T3.2 Sensorimotor Analytics of Daily Activities.** |
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Project PLAYTIME

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# Contents

# 1 Executive Summary

Measuring physical activity and physical performance can give great insights in the early signs and progression of dementia. Ambulatory monitoring is very suitable for measuring patients in daily life and under controlled conditions.

In Playtime, the goal is to add parameters to the existing MoveTest and MoveMonitor, that give insight in the (progression of) dementia. These parameters will also be added to an existing conceptual framework, backed up by the data originating from field studies and literature. The focus of this deliverable is on the software changes, while Deliverable 4.3.1 focusses on the hardware and the integration into the Playtime solution.

Literature will be reviewed to identify movement parameters that are related to (progression of) dementia and how to measure these parameters. When a set of parameters has been identified, they will be incorporated in the MoveMonitor and/or MoveTest software. As these software modules will be linked to the PLAYTIME suite (see WP 4), these dementia specific parameters will also be available to PLAYTIME users.

The main focus will be on gait parameters as literature provides a lot of evidence on the effect of dementia on gait. In PLAYTIME, not only total walking will be included, but also weekly patterns and quality of gait (walking speed, variability, and stability).

The way these parameters will be measured during PLAYTIME and presented to the subjects will be described in detail in WP4. In general, short physical capacity tests will be incorporated in a game played in a group setting. A group leader will perform MoveTest measurements on the subjects at the beginning and at the end of a predefined period (the intervention). Next to the MoveTest measurements, a subject will be asked to wear a MoveMonitor for 1 week. In this way, measurements will be performed in both a controlled and an uncontrolled stetting (i.e. daily life). The results will be fed back to the subjects and their (informal) caregivers through the PLAYTIME app.

# 2 Introduction

The MoveMonitor (MM) and MoveTest (MT) provide an overall picture of the physical function of the patient. The MT provides insight into what the patient can do, and the MM monitors what the patient actually does in daily life. They work on the same data platform. McRoberts uses a conceptual framework to describe relations between parameters that can be measured using both

## 2.1 MoveTest

The MT is designed to easily and reliably assess standardized physical performance tests under supervised (controlled) conditions. It consists of hardware (DynaPort MT), software for data analysis and a data management platform. The DynaPort MT consists of a tri-axial accelerometer, tri-axial gyroscope, temperature sensor, air pressure sensor, a magnetometer and Bluetooth. The DynaPort MT is worn on the lower back using an elastic strap. This location is close to the Centre of Mass (CoM), representing whole body movement (in contrast to arm worn sensors where limitations can occur due to absence of arm swings or arm swings unrelated to whole body movements).The following software modules (i.e. performance tests) are implemented along with the hardware:

- Sit-to-Stand
- Timed Up and Go
- Gait
- Sway
- Short Physical Performance Battery
- 6-Minute Walk Test

These performance test cover a broad range of the physical performance of a subject (e.g. gait, transitions, balance, turns), but are not specifically aimed at investigating dementia-specific changes that happen in the early stages of the disease.

## 2.2 MoveMonitor

The MM is designed to measure physical activity in daily life (i.e. unsupervised and uncontrolled conditions) and  This MM consist of hardware (DynaPort MM) ), software for data analysis and a data management platform. The MM is used in international research projects, pharma trials, and clinical practice to measure many aspects of mobility in the real world on a long-term basis.

The DynaPort MM consists of a tri-axial accelerometer, temperature sensor, air pressure sensor, and magnetometer. For research purposes, the DynaPort MM+ is also available which

had an additional 3-axial gyroscope compared to the DynaPort MM. The DynaPort MM is worn on the lower back using an elastic strap. This location is close to the Centre of Mass (CoM), representing whole body movement (in contrast to arm worn sensors where limitations can occur due to absence of arm swings or arm swings unrelated to whole body movements). We developed and validated non-wearing detection as well.

With the MM it is possible to assess a subjects' physical activity in daily life, for up to 14 consecutive days. We provide a broad range of physical activity parameters, e.g. time spent in postures and movements, amount of steps and movement intensity.

## 2.3 Relation between MoveTest and MoveMonitor: conceptual framework

The MM and MT share the same hardware and software platform, but deliver different outcome parameters. McRoberts uses a conceptual framework (theoretical framework) to map the relations between the outcomes of the 2 products.

Conceptual frameworks are a type of intermediate theory that attempt to connect to all aspects of inquiry (e.g., problem definition, purpose, literature review, methodology, data collection and analysis). Conceptual frameworks can act like maps that give coherence to empirical inquiry. Because conceptual frameworks are potentially so close to empirical inquiry, they take different forms depending upon the research question or problem.

For measures of general concepts, we review how individual items are thought to be associated with each other, how they are associated with each domain, and how domains are associated with each other and the general concept of interest based on the framework. The diagram in Figure 1 depicts a generic example of a conceptual framework where Domain 1, Domain 2, and General Concept each represent related but separate concepts. Items in this diagram are aggregated into domains. The final framework is derived and confirmed by measurement property testing.

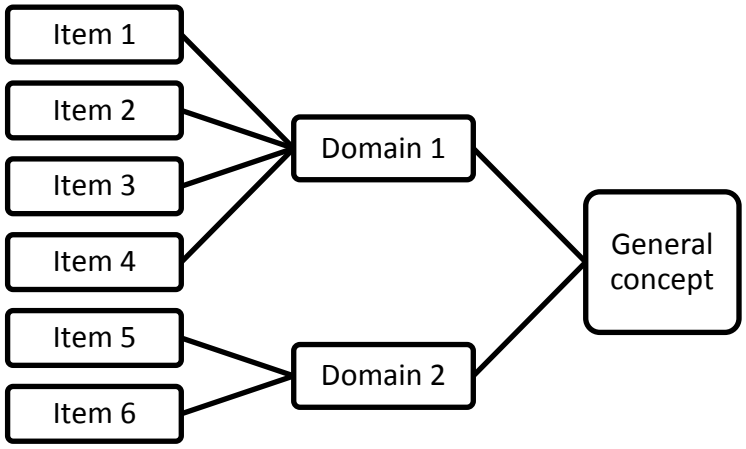


*Figure 1: Diagram of the concept of a conceptual framework.*

The MT and MM measure different aspects of Physical Functioning (PF). The MT measures Physical Capacity (PC; What can you do?) and the MM measures Physical Activity (PA; What do you actually do?). PC and PA can also be measured using more traditional measures (e.g. questionnaires) but these have the tendency to be less objective compared to ambulatory monitoring. Figure 2 shows a simplified conceptual framework of how PF (with its domains PC and PA) can fit in a general conceptual framework of General Health. Subjective measures are also included (yellow boxes). General concepts and domains are shown in blue. This conceptual framework has been researched and is was found that PC and PA are indeed separate, but related domains [1].

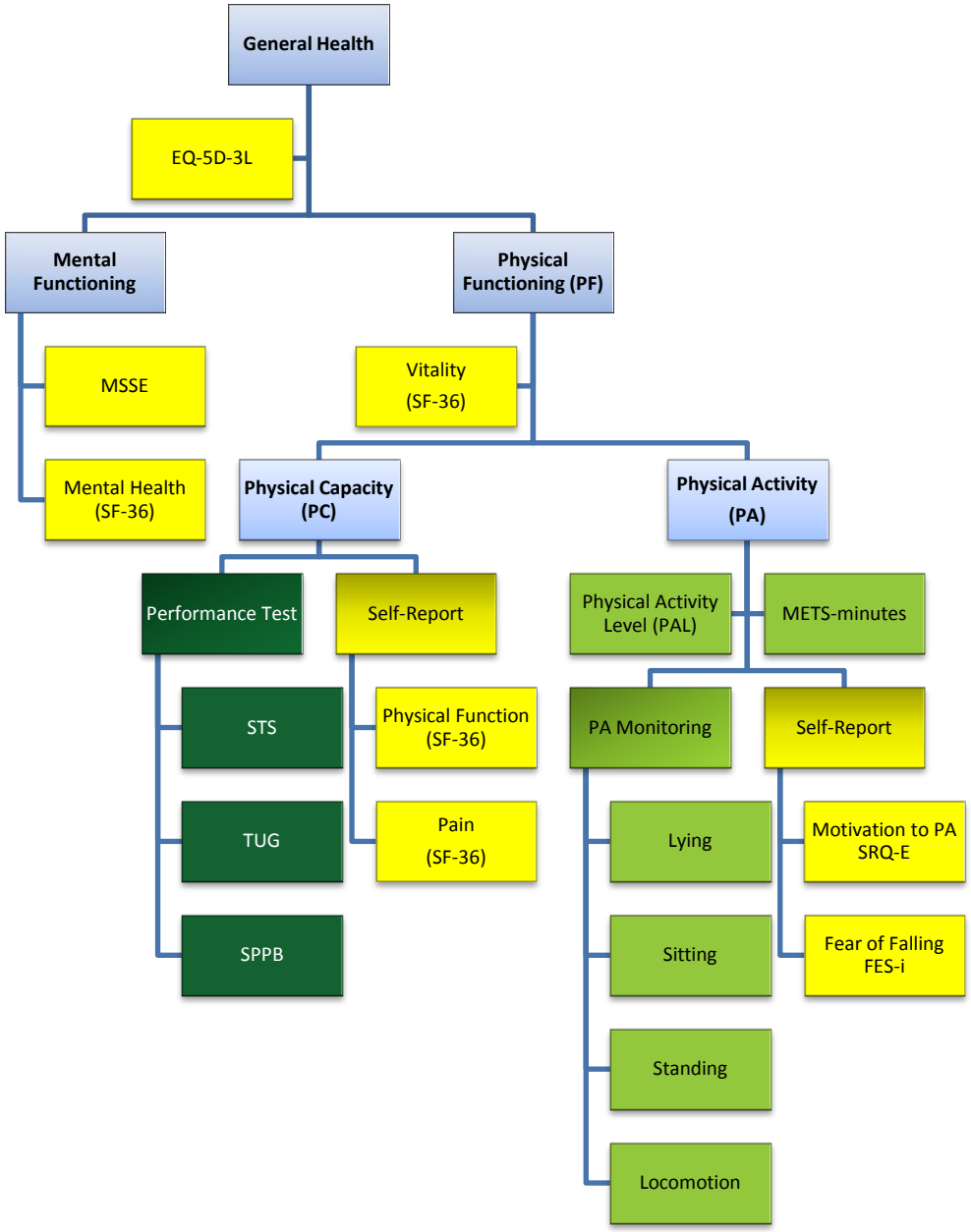


*Figure 2: Diagram of McRoberts' conceptual framework. Blue: General concepts and domains; Yellow: Subjective measures; Dark green: MT; Light green: MM.*

## 2.4 Goal of this deliverable.

In Playtime, the goal is to add parameters to the existing MoveTest and MoveMonitor, that give insight in the (progression of) dementia. These parameters will also be added to the existing conceptual framework, backed up by the data originating from field studies and literature. The focus of this deliverable is on the software changes, while Deliverable 4.3.1 focusses on the hardware and the integration into the Playtime solution.

To this end, literature will be reviewed to identify movement parameters that are related to (progression of) dementia and how to measure these parameters. When a set of parameters has been identified, they will be incorporated in the MoveMonitor and/or MoveTest software. As these software modules will be linked to the PLAYTIME suite (see WP 4), these dementia specific parameters will also be available to PLAYTIME users.

# 3 Movement disorders in patients with dementia

A literature search was performed on movement disorders in patients with dementia. Table 1 sums up the outcomes of this study. It can be concluded from this study that research on movement characteristics and the effect of the disease thereon is still in the early phase, but the consensus is that gait (and its related parameters) is affected by (progression of) the disease. Also, effects of the disease on balance and transitions were found, but most literature points in the direction of gait analysis.

## 3.1 Change of gait parameters in patients with dementia

A general consensus within literature is that gait (both quality and quantity) is affected by (the progression of) dementia. Not only the total amount of walking (e.g. steps) per day can give valuable insights in progression of the disease, but also walking stability, variability and speed. It was also found that dual tasking challenges a subject more and that this increases the effects of the disease on gait parameters.

## 3.2 Change of balance parameters

Although a lot of research can be found on balance and ageing in general, little background on balance parameters can be found. A paper of Visser [2] shows an increase in body sway during a stationary test (10 seconds standing still). As very little research on balance and evidence of significance can be found, this will not be in focus for PLAYTIME.

## 3.3 Lower limb funtion

Little research has been done in this field, but Eggermont *et al* [3] showed association between cognitive impairment and lower-limb function in older persons as assessed by the four-meter walk test (4MWT), Timed Up & Go (TUG) test, and sit-to-stand (STS) test . In PLAYTIME, the assessment of lower limb function will be incorporated in the form of the Short Physical Performance Battery (SPPB) [4]. This battery includes sway, 4 meter gait, and repeated sit-to-stand tests.

*Table 1. Literature overview of dementia related changes in movement characteristics.*

| Author | Year | Title | Methods | Conclusion |
|---|---|---|---|---|
| H. Visser [2] | 1983 | Gait and balance in senile dementia of Alzheimer's type. | 11 subjects | The demented patients had significantly shorter step length, lower gait speed, lower stepping frequency, greater step-to-step variability, greater double support ratio and greater sway path. |
| J. Verghese *et al.* [5] | 2002 | Abnormality of gait as a predictor of non-alzeheimer's dementia. | 422 subject<br>• Age: 75-85 years<br>• Females: 64.5%<br>• Neurologic abnormalities affecting gait diagnosed by board-certified neurologists | The presence of **neurologic gait abnormalities** in elderly persons without dementia at base line is a significant **predictor** of the risk of development of **dementia**, especially non-Alzheimer's dementia. |
| L.M. Allan *et al.* [6] | 2005 | Prevalence and Severity of Gait Disorders in Alzheimer's and Non-Alzheimer's Dementias. | • 245 subjects: 46 Parkinson's disease with dementia, 32 dementia with Lewy bodies, 39 vascular dementia, 40 Alzheimer's disease, 46 Parkinson's disease, and 42 controls<br>• Gait and balance assessment scales previously validated by Tinetti [7] | The study confirms that **gait and balance disorders** occur **most commonly** in patients with **non-Alzheimer's dementias**. Gait and balance disorders were **less common in AD**, although they were more common overall than in age-matched controls. |
| O. Beauchet *et al.* [8] | 2008 | Gait analysis in demented subjects: Interests and perspectives | Literature study, 40 papers included | **Gait assessment**, and more particularly dual-task analysis, is **crucial in early diagnosis of dementia** and/or related syndromes in the elderly. Moreover, dual-task disturbances could be a specific marker of falling at a pre-dementia stage. |
| L.H. Eggermont *et al.* [3] | 2010 | Lower-Extremity Function in Cognitively Healthy Aging, Mild Cognitive Impairment, and | • Older persons (N=66) were studied (mean age, 76.7y); 22 were cognitively normal, 22 were | The results suggest an **association between cognitive impairment and lower-limb function** in older persons. **Walking speed** could be evaluated for |

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| | | Alzheimer's Disease | diagnosed with probable MCI, 22 were diagnosed with probable AD.<br>• Lower-extremity function was assessed by the four-meter walk test (4MWT), Timed Up & Go (TUG) test, and sit-to-stand (STS) test | its **possible utility in screening** older persons at **risk for cognitive impairment and falls.** |
| S.W. Muir *et al.* [9] | 2012 | Gait assessment in mild cognitive impairment and Alzheimer's disease: The effect of dual-task challenges across the cognitive spectrum | • Twenty-two older adults with normal cognition, 29 with MCI and 23 with AD were included<br>• Gait velocity and stride time gait variability were the primary outcomes. | **Gait changes under dual-tasking** for the **MCI and AD groups** were statistically **different** from the cognitively **normal controls**. **Dual-task assessment** exposed gait impairments not obvious under a single-task test condition and **may facilitate falls risk identification** in cognitively impaired persons without a history of falls. |
| M. Jamour *et al.* [10] | 2012 | Gangveränderungen als Frühindikator einer Demenz | Literature study | **Prevalence** of dementia-associated **gait disturbances depends on** the **type** of dementia **and the severity** of cognitive impairment. While in vascular dementia gait abnormalities are often clinically apparent at early disease stages, Alzheimer's disease patients usually have stable gait until late disease stages.<br>**Dual-task paradigms are useful to test available resources**. It has been shown in early Alzheimer's disease patients that, if the demand of attention exceeds available capacities, quantitative gait changes occur. Relevant parameters seem to be, e.g., **walking speed and stride-time variability**. Quantitative assessment of gait dysfunction in dementia may, thus, have the potential to serve as a trait marker. |
| O. Beauchet *et al.* [11] | 2013 | Gait variability at fast-pace walking speed: A biomarker of | • 116 subjects: 44 control, 39 MCI patients and 33 AD | **High STV** at fast-pace walking speed was a specific gait **disturbance of MCI** patients in the sample of |

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| | | mild cognitive impairment? | | studied participants, and thus could be used in the future as a specific biomarker of MCI patients. Subjects with **mild AD** showed **lower WS** (during usual and fast-pace walking) **and higher STV** during usual-pace walking. |
| J.M. Hausdorff and A.S. Buchman [12] | 2013 | What Links Gait Speed and MCI With Dementia? A Fresh Look at the Association Between Motor and Cognitive Function | Literature overview | **Motor cognitive risk (MCR)** is a provocative concept. It further underscores the link between walking and thinking, raises important questions regarding the neurobiological substrate of late-life cognitive and motor impairment, and may provide a means to improve the detection of older individuals who have a high risk of developing dementia. Extending the present findings, one can speculate that MCR **may also enhance the prediction of motor decline and falls** among older adults. |
| S. Boripuntakul *et al.* [13] | 2013 | Spatial variability during gait initiation while dual tasking is increased in individuals with mild cognitive impairment | Spatiotemporal stepping characteristics and variability under single- and dual-task conditions (counting backwards by 3s) were assessed in 30 older adults with MCI and 30 cognitively intact controls. | **Step length and step width variability is increased in people with MCI during gait initiation**, particularly in a condition involving a secondary cognitive task. These findings suggest that individuals with **MCI** have **reduced balance control** when undertaking a challenging walking task such as gait initiation, and this is exacerbated with an added cognitive task. |
| M. Montero-Odasso [14] | 2014 | The Motor Signature of Mild Cognitive Impairment: Results From the Gait and Brain Study | Ninety-nine participants, 64 with MCI (mean age 76.3 ± 7.1 years; 50% female) and 35 controls (mean age 70.4 ± 3.9 years; 82.9% female) were included in the analy- sis. In the MCI group, 42 were a-MCI and 22 were na-MCI. | Participants with **a-MCI**, specifically with episodic memory impairment, had **poor gait performance**, **particularly under dual tasking**. Our findings suggest that dual-task assessment can help to differentiate MCI subtyping, revealing a motor signature in MCI. |
| Y.L. Hsu *et al.* [15] | 2014 | Gait and Balance Analysis for Patients With Alzheimer's Disease Using an Inertial- | • 71 participants: 21 AD and 50 controls. | Experimental results show that the wearable instrument with the designed **gait and balance analyzing system** is a promising tool for automatically |

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| | | Sensor-Based Wearable Instrument | • Stride detection followed by gait cycle decomposition so that gait parameters are developed from the decomposed gait details.<br>• Balance is measured by the sway speed in anterior-posterior (AP) and medial-lateral (ML) directions of the projection path of body's center of mass (COM). | analyzing gait information and balance ability, serving as assistant **indicators for early diagnosis of AD**. |
| O. Beauchet *et al.* [16] | 2014 | Gait Changes with Anti-Dementia Drugs - A Prospective, Open-Label Study Combining Single and Dual Task Assessments in Patients with Alzheimer's Disease | A total of 86 patients with mild-to-moderate AD (19 patients using acetylcholinesterase inhibitors, 36 patients using memantine and 31 age- and gender-matched patients without anti-dementia drugs). Mean values and coefficient of variation of walking speed and stride time were measured while usual walking and while walking with backward counting. | Our findings showed a double dissociation in the **effect of anti-dementia drugs on gait variability** in patients with possible or probable Alzheimer's disease: memantine improves gait variability while single tasking, whereas acetylcholinesterase inhibitors improves gait variability while dual tasking |
| R. Mc Ardle *et al.* [17] | 2017 | What Can Quantitative Gait Analysis Tell Us about Dementia and Its Subtypes? A Structured Review | Structured literature review | **Dementia** was associated with gait characteristics grouped by **slower pace, impaired rhythm, and increased variability** compared to normal aging. Only four studies compared two or more dementia subtypes. People with AD are less impaired in pace, rhythm, and variability domains of gait compared to non-AD dementias. Results demonstrate the potential of gait as a clinical marker to discriminate between dementia subtypes. |

*MCI: Mild Cognitive Impairment, AD: Alzheimer's Disease, STV: Stride time variability, WS: walking speed, MCR: motor cognitive risk, a-MCI: amnestic MCI, na_MCI: nonamnestic MCI*

# 4 Measuring movement parameters

From the literature study described in section 3 it is concluded that gait and its related parameters are important in investigating progression of the disease and possible effects of an intervention. Balance and transitions (proxy of lower-limb strength) seem to be of less importance based on literature. This section describes methods to quantify walking behavior and more specific walking quality under real life conditions. Walking under real life conditions is essential for independent living especially for frail elderly and older adults with chronic diseases. Additionally, balance and transition parameters will be described.

In the FARAO project (Vrije Universiteit Amsterdam) quality of gait using McRoberts sensors was used to quantify walking periods measured in daily life to improve existing methods to predict falls [18]. In this study walking bouts of 10 seconds locomotion analyzed with the MoveMonitor software and longer were used to analyze quality of walking. Locomotion includes all types of displacement including walking stair walking and cycling. In FARAO we learned that cleaning of the locomotion episodes was needed. The development of methods to detect cycling and stair climbing and add these to the automatic physical activity analysis was an important improvement. The next step to get clean walking data is to detect turns during walking bouts in order to be able to identify bouts of straight walking.

The aim of this section is to give an overview of potential endpoints for interventions like PLAYTIME.

## 4.1 Total walking

When looking at total walking, there are different possibilities [19]

a) Amount of steps per day. This is an easy to understand number, but one can look more into detail of how daily life gait can be quantified:
    1. Steps per day (from walks ≥ 3 steps)
    2. Walks per day (of walks ≥ 8 steps)
    3. Steps per walk (mean of walks ≥ 8 steps)
    4. Longest walk per day.

b) Mean total walking time per day
    1. WALKING_periods_10: number of walking periods below or equal to 10 seconds
    2. WALKING_periods_10.20: number of walking periods above 10 seconds and below or equal to 20 seconds
    3. WALKING_periods_20: number of walking periods above 20 seconds

c) Movement intensity during walking
    1. Walking intensity: average movement intensity of walking periods

## 4.2 Weekly patterns

Studies performed Brodie et al [19],[20] give suggestions how to measure weekly patterns. On top of a parameter (single value over a time period), patterns, and their change over time, can give valuable insights in the progression of the disease. Figure 3 shows an example of the different parameters below, for 4 types of subject: Impaired, Restrained, Active, and Athletic participant.

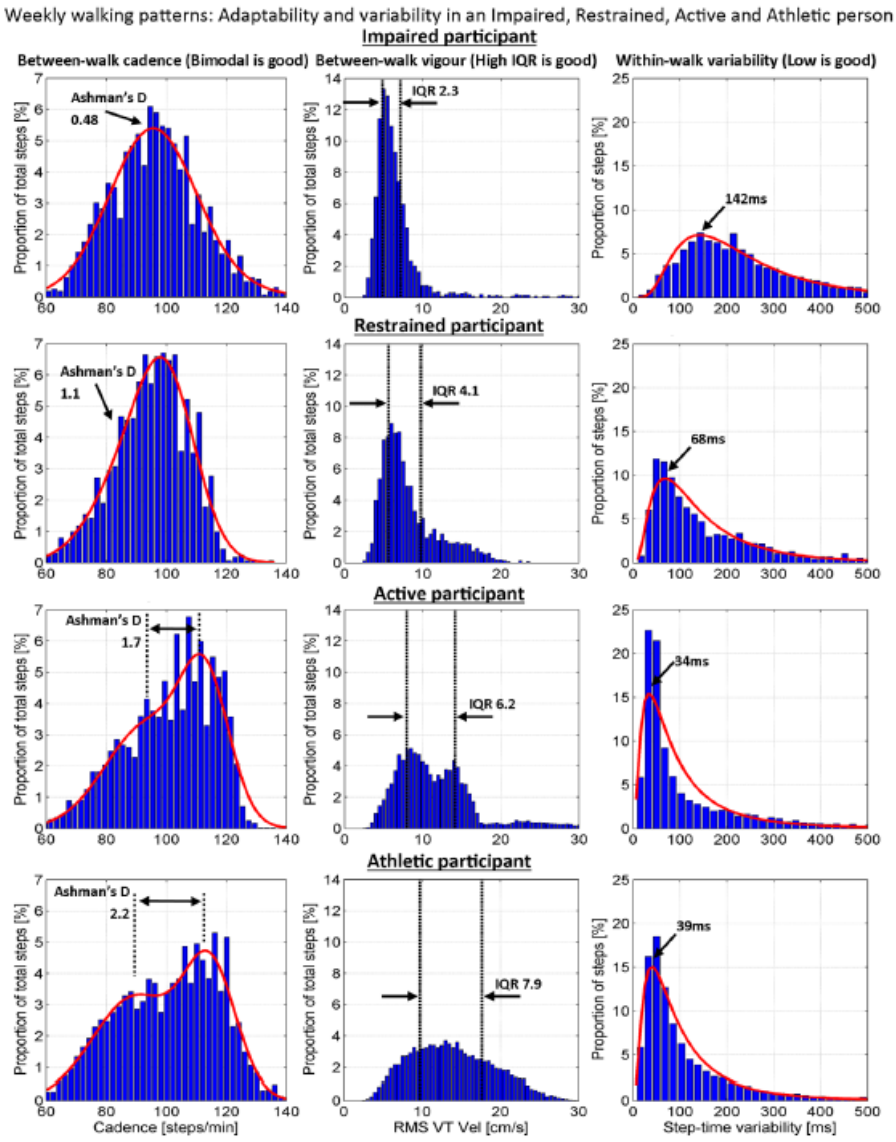


*Figure 3: Example of weekly patterns in gait parameters*

a) Between walk cadence
   Mean cadence can be measured by the number of stepping peaks divided by the walk duration. Greater cadences indicate more intense walking exercise and therefore better health [21].

b) Between walk vigor
Median vigor can be measured by the root mean squared (RMS) of vertical oscillation velocity of the pelvis [22]. Because in daily life, the distribution is not normal, the median value should be used.
Gait vigor is highly correlated with both step lengths and walking speed and greater values indicate more intense walking and therefore better health [21].

c) Within walk variability
Intrinsic variability can be measured using the standard deviation of step times for each sequence of 8 steps. During daily life, measures of variability follow a log normal distribution and therefore the mode (most popular value or peak of the histogram) is used to measure central tendency.

## 4.3 Quality of walking

a) A slow or decline in walking speed is identified by many studies (Table 1) as an indicator for early diagnosis of dementia. Estimation walking speed therefore is therefore an important addition to the MoveMonitor or MoveTest analysis software.

1. Zijlstra & Hof [23] have tried to assess spatio-temporal gait parameters from trunk accelerations during human walking. They concluded that, in healthy subjects, the duration of subsequent stride cycles and left/right steps, and estimations of step length and walking speed can be obtained from lower trunk accelerations (figure 4). This method needs to be investigated for application in people with dementia as it is possible that changed gait patterns could challenge the implementation of this method.

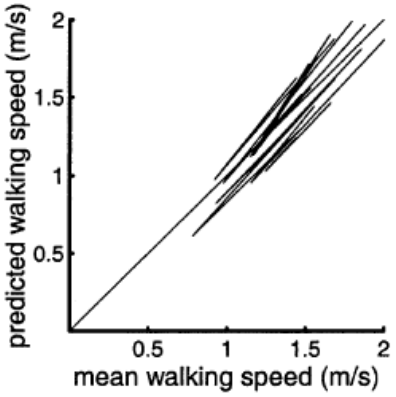


*Figure 4: Predicted walking speed versus mean walking speeds during overground walking* [23]

2. A study performede by Brodie *et al* [24] used a wavelet-based method to show that daily life and laboratory gaits are different. They also found that laboratory assessment of walking speed was most correlated with RMS vertical acceleration during free-living ($r = 0.68$, $p < 0.001$), which indicates that this parameter could be used as a proxy for gait speed.

b) Walking stability and variability

1. **Lateral Harmonic Stability** has been used before to measure gait stability, but Brodie *et al* [25] proposed the 8-step medio-lateral harmonic ratio (8-step MLHR). This measure better discriminated fallers from non-fallers compared to the traditional MLHR. It was also found that a good 8-step MLHR coincides with adequate gait speed.
2. Rispens *et al* [26] investigated the consistency of gait characteristics as determined from acceleration data collected at different trunk locations. In that study, 35 gait characteristics were evaluated at different locations on the body, including the location of McRoberts' sensors. Next to stride parameters (**time, frequency, regularity), movement intensity, gait smoothness and symmetry, and Local Dynamic Stability (LDS)** were included. The latter is a complex method and has been shown to be useful for fall risk assessment. Van Schooten *et al* [29] showed methods for estimating gait variability and stability from short bouts of gait. Local dynamic stability can be reliably assessed from short bouts of gait. The number of required bouts of strides for valid estimation of **local dynamic stability** possibly limits its use in clinical assessment, highlighting the importance of estimation based on daily-life ambulation, where multiple bouts can be recorded over a longer period.
3. **Pelvic stability and pelvic sway** was investigated by Brodie *et al* [27], [28]. Movements of the pelvis (measured using an inertial sensor) discriminate subjects with gait disorders from healthy subjects (figure 5). It was also found that gyroscopic corrections improve wearable sensor data prior to measuring dynamic sway in gait.

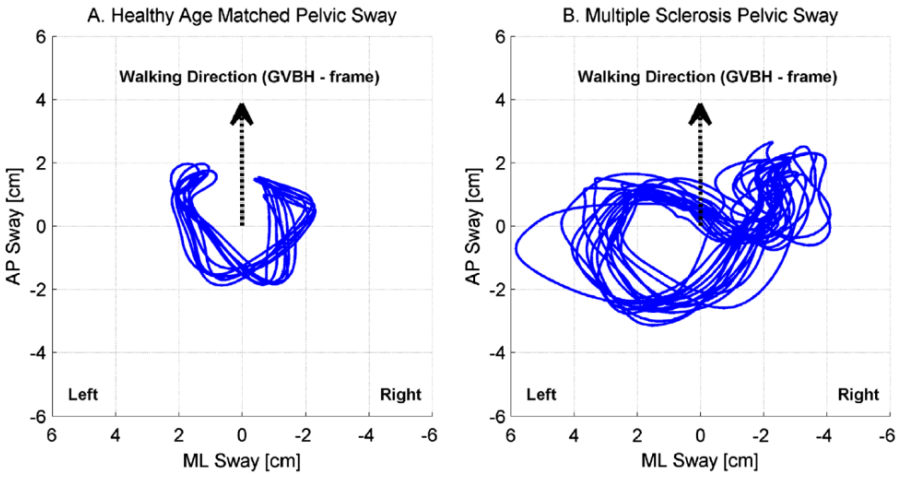


*Figure 5: pelvic sway during walking of control subjects and subjects with MS.*

4. Gait variability has been investigated by Hausdorff *et al* [30].
It was found that, among community-living older adults attending an outpatient geriatric clinic, **increased gait variability** is associated with an increased risk of future falls. In fact, the likelihood of falling was increased about fivefold with only a moderate increase in stride time variability (table 1). Second, in this population of older adults, measures of **variability** were not only **associated** with many factors

that are intuitively related to fall risk, such as strength, balance, and gait, but also with **vitality and mental status**. Third, **stride time variability** was also strongly associated with self-report and performance-based measures of functional status, some of which have been shown to predict clinical outcomes such as morbidity and nursing home admission.

In a study by the same author [31], it was observed that older adults with mild cognitive impairments (MCI) performed **poorer on in-lab measures of balance, gait and mobility** than age-matched older adults who did not have MCI or dementia. It was found that not only is mobility capacity altered, but mobility function, as reflected in daily life ambulation, is also changed in MCI. **Everyday stepping quantity and stepping quality were reduced in MCI**, compared to age-matched controls. In addition, mobility capacity and mobility function were only moderately related to each other, similar to findings in other cohort. Next to this, it was also found that measures of mobility capacity and function were independently associated with group assignment. Taken together, these results suggest that **measures of everyday walking reflect aspects of mobility that are not simply a mirror-image of the gait and balance changes measured in the lab setting**.

# 5 Conclusions and Outlook

The goal for PLAYTIME is to add parameters to McRoberts' existing MoveTest and MoveMonitor analyses, that give insight in the (progression of) dementia. The main focus will be on gait parameters as literature provides a lot of evidence on the effect of dementia on gait. In PLAYTIME, not only total walking will be included, but also weekly patterns and quality of gait (walking speed, variability, and stability).

The way these parameters will be measured during PLAYTIME and presented to the subjects will be described in detail in WP4. In general, short physical capacity tests will be incorporated in a game played in a group setting. A group leader will perform MoveTest measurements on the subjects at the beginning and at the end of a predefined period (the intervention). Next to the MoveTest measurements, a subject will be asked to wear a MoveMonitor for 1 week. In this way, measurements will be performed in both a controlled and an uncontrolled stetting (i.e. daily life). The results will be fed back to the subjects and their (informal) caregivers through the PLAYTIME app.

# 6 Glossary

**Table 2**. *Glossary.*

| Notion | Description |
|---|---|
| **Accelerometer** | An accelerometer is a device that measures proper acceleration, being the rate of change of velocity of a body. |
| **DynaPort** | McRoberts' hardware line consisting of DynaPort MM, MM+ and MT (current systems) and the to be developed DynaPort MX and MM2 |
| **Gyroscope** | A gyroscope is a device used for measuring orientation and angular velocity. |
| **Magnetometer** | A magnetometer or magnetic sensor is an instrument that measures magnetism. In recent years, magnetometers have been miniaturized to the extent that they can be incorporated in integrated circuits at very low cost and are finding increasing use as miniaturized compasses |
| **MoveMonitor** | McRoberts solution (hardware and software) for measuring physical activity in daily life. |
| **MoveTest** | McRoberts solution (hardware and software) for measuring physical capacity in controlled settings. |

# 7 Abbreviations

**Table 3**. *Abbreviations.*

| Abbreviation | Description |
|---|---|
| **a-MCI** | amnestic MCI |
| **AD** | Alzheimer‘s Disease |
| **MCI** | Mild Cognitive Impairment |
| **MCR** | motor cognitive risk |
| **na_MCI** | nonamnestic MCI |
| **MM** | MoveMonitor |
| **MT** | MoveTest |
| **STV** | Stride time variability |
| **WS** | walking speed |

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