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Background. Focus of attention is known to play an important role in motor skill learning, yet little is known about how attention is directed within the context of stroke rehabilitation.

Objective. The aims of this study were: (1) to identify physical therapists’ use of internal and external focus of attention during gait rehabilitation for individuals with hemiplegia following stroke and (2) to use the findings to design an experimental study examining the impact of focus of attention on learning poststroke.

Design. The study design involved direct nonparticipation observation of physical therapy treatment sessions.

Methods. Eight physical therapy treatment sessions, in which gait rehabilitation was taking place, were video recorded. Patients were aged between 36 and 85 years, and ranged from 7 to 216 days poststroke; physical therapists had between 3 and 12 years of experience in stroke rehabilitation. Data analysis took 2 forms: (1) clear definitions of internal and external focus of attention were agreed on via a consensus group and used to develop an analysis matrix through which incidences of instruction and feedback were identified, categorized, and counted; and (2) verbal dialogue was transcribed verbatim and transcripts were thematically analyzed to provide a detailed description of how instructions and feedback were used, illustrated by examples.

Results. The use of instructions and feedback (internal and external focus) was high; an average of one verbal instruction or feedback statement was delivered every 14 seconds. Sixty-seven percent of the statements were internally focused, 22% were externally focused, and 11% were of mixed focus. Unfocused statements (e.g., “good”) also were used regularly. Patients were frequently encouraged to “think about” their performance.

Limitations. Observational data collection methods may result in changes in the behavior of those observed, which is a potential source of bias. The small sample size also was a limitation of the study.

Conclusion. Physical therapists frequently encouraged patients to be aware of their movements and their performance (internal focus). This approach may reduce automaticity and hinder learning and retention.
Attention plays a key role in learning and has been the subject of much debate in the motor learning literature. Whether performed consciously or subconsciously, almost everything we do requires some attention. Therefore, attention refers to what we are thinking about (or not thinking about), or what we are aware of (or not aware of), when we perform activities.

The term “attentional focus” refers to the location of an individual’s attention in relation to the performance environment/task. This focus may be either internal or external. An internal focus is directed toward components of the body movement, where the learner will be consciously aware of how they are performing. Conversely, an external focus is directed toward the effect of the movement on the environment, or the end goal. For example, when practicing throwing a ball, a performer might focus internally toward the movement of the wrist, elbow, and shoulder, or might focus externally toward the ball and its target.

Attentional focus is known to have an important influence on both performance (the behavioral act of executing a skill at a specific time point) and learning (a relatively permanent improvement in skill execution as a result of practice or experience). In an original study by Wulf et al, participants who were healthy performed slalom-type movements on a ski simulator while being prompted to focus attention toward either their feet (internal) or the wheels of the platform (external). A third group received no focus instructions (control). The externally focused group demonstrated enhanced learning compared with the internal focus and control groups. The relative benefits of an external focus of attention have since been replicated in numerous studies involving individuals who were healthy performing motor tasks, including golf putting, shooting basketball hoops, long jumping, and treadmill running. Although there is limited research involving individuals with a history of stroke, one study with a small sample showed that the provision of explicit (internally focused) information was detrimental to performing and learning of a dynamic balance task in individuals with chronic stroke.

Instruction and feedback from a “coach” (or therapist) play an important role in directing attention of a performer. Within therapy, a number of studies have used observational methods to explore and describe communication practices. These studies examined the prevalence and content of verbal communication and provided detailed insights into nonverbal behavior and social interaction. They consistently showed that therapists spend considerable therapeutic time talking to their patients and that instructions and feedback are used frequently. However, only one previous study considered the use of instruction and feedback in terms of attentional focus. Durham et al observed physical therapists during treatment sessions focused on upper-limb rehabilitation. Statements of instruction or feedback were identified and categorized according to their attentional focus. Overall, 79% of all instructions and 96% of all feedback statements were internally focused. Thus, therapists frequently told patients what to do and how to do it. A major limitation of that study was that therapists were told the purpose was to examine the use of internal and external focus feedback and were given definitions of these terms. This knowledge of the study objectives could have altered the behavior of the therapists during the observation. Furthermore, as the study involved a small number of therapists and considered only upper-limb rehabilitation, it is not known whether the findings are reflective of physical therapist practice as a whole.

Although attentional focus has important implications for motor learning in individuals who are healthy, relevance to the rehabilitation of individuals with stroke is unknown. This study aims to replicate the work of Durham and colleagues within a different area of physical therapist practice, namely gait rehabilitation. It is the first part of a research program investigating the impact of attentional focus on motor learning poststroke. Prior to designing a clinically relevant experimental study, it was important to understand more about the concept of attentional focus within the context of stroke rehabilitation. In particular, we sought to understand whether the bias toward the use of internally focused statements, as reported by Durham and colleagues, also applied within a gait rehabilitation setting. This article reports our findings about current practice among physical therapists in relation to the learning strategies used during gait re-education poststroke, with particular reference to the timing, frequency, and attentional focus of instructions and feedback. The findings have informed the development of a trial comparing different approaches to learning during gait re-education poststroke.

### Method

#### Study Design

This study used direct nonparticipation observation of physical therapy treatment sessions, with data collected through video recording.
Participants

Physical therapists were recruited based on the following inclusion criteria: currently working within a neurological rehabilitation setting, having at least 1 year of experience working in neurology at a senior level, and treating patients with stroke on a regular basis (at least fortnightly).

Physical therapists who agreed to participate were asked to identify patients who met the following criteria: had had a stroke, currently receiving rehabilitation that included gait re-education, and able to provide informed consent. To ensure that we gained insight into a range of clinical scenarios, there were no specific criteria relating to participant’s level of walking ability, other than that the therapist considered his or her intervention to include “gait rehabilitation,” including working toward standing and stepping in the early stages of recovery. All participants (both patients and physical therapists) were told that the research aimed to investigate how physical therapists worked with patients to re-educate gait; no references to focus of attention were made. This aim was kept broad to avoid changes in practice behavior resulting from knowledge of the study objectives. To ensure sufficient numbers and to avoid local bias in practice, participants were recruited from 2 separate hospitals.

Demographics and Measures

Patient demographics, type of stroke, time since stroke, and side of hemiplegia were taken from the medical notes. In addition, the researcher completed the modified Rivermead Mobility Index (mRMI) for each participant. This outcome measure rates the individual’s ability to perform 8 mobility tasks, from rolling over in bed to climbing stairs. It is scored out of a total of 40 points, with a higher score indicating a better level of physical independence.

Data Collection

Physical therapy treatment sessions, involving patients known to the therapist, were video recorded. Physical therapists were not given any guidance regarding the duration or content of the session, except that it must include gait re-education.

“Good practice” strategies for observational research were followed, for example: building good rapport with participants, carrying out observations in a familiar and natural environment, and minimizing distractions (including avoiding the presence of other patients or professionals). In order to remain discreet, the researcher was positioned several meters away from the participants and outside of their main line of vision. They did not intervene in the session in any way, avoided unnecessary movements and eye contact, and did not speak during the observation. Data were collected using a small and unobtrusive video recorder mounted on a tripod.

Data Analysis

Data analysis had 2 aims: (1) to identify, categorize, and count incidences of instruction and feedback using quantitative methods and (2) to describe in-depth how instruction and feedback were provided using thematic analysis. Therefore, the following mixed-methods approach was adopted.

Quantitative analysis using an analysis matrix. Analysis identified both the physical therapists’ and patients’ physical and verbal actions relating to instruction and feedback, categorizing observations with regard to their content, attentional focus, and frequency. An analysis matrix was used to achieve this quantitative analysis. As no a priori definitions existed by which to classify these behaviors, an iterative process as outlined by Haidet et al was adopted. This process involved defining target behaviors, applying these definitions to the data using the analysis matrix, testing for inter-rater agreement, refining definitions, and retesting. An annotated example of a completed matrix (final version) is given in the Appendix.

The primary researcher (L.J.) drafted the initial matrix using definitions constructed from the literature and from observation of the videos. The primary researcher and 2 other experienced neurological physical therapists who had not been study participants then applied the draft matrix independent of each other. A cyclical process of testing and refinement was repeated, with each researcher’s results being compared using Cohen kappa. Percentage point agreement was calculated for each category. Where agreement was poor, categories were reconsidered and refined, either by clarifying the definitions or combining categories. A total of 7 testing cycles took place, each using sections from different videos, before an acceptable level of inter-rater agreement (set at $\kappa > 0.60$) was achieved. The final matrix then was applied to each video by the primary researcher. As data were not normally distributed, nonparametric descriptive statistics were used to summarize the findings.

Qualitative thematic analysis. Alongside the quantitative analysis, the content of the transcripts and videos was thematically analyzed (by L.J.) to describe behaviors and provide examples of the interactions observed. Thematic analysis, broadly based on the approach described by Pope et al, was used. Initial familiarization occurred during development of the analysis matrix already described. Statements of instruction, feedback, and general information were identified and coded according
to their attentional focus. Information of the same code type then was considered: (1) within each transcript and (2) between the different transcripts. Data were synthesized into charts relating to each code. These charts were analyzed to define concepts and draw associations and interpretations relating to attentional focus.

**Results**

Letters of invitation were sent to all eligible physical therapists employed by the 2 hospitals (n = 16). Eight therapists responded and agreed to take part in the study. All physical therapists were female (there were no male physical therapists working in either department). Each therapist identified an appropriate patient from her case load, all of whom agreed to take part in the study after meeting with the researcher. Of the 8 patient participants, 5 were male and 3 were female. Time since stroke varied from 7 to 216 days (X = 90.25, SD = 83.13). Four patients had left-sided hemiplegia, and 4 had right-sided hemiplegia. Four patients were able to mobilize without physical assistance, 3 were able to mobilize with some assistance, and 1 was not yet able to walk but could practice activities while standing with support. Modified Rivermead Mobility Index scores reflect this varying level of function, with a range between 15 and 38 out of 40. The duration of the recorded treatment sessions ranged from 27 to 50 minutes (X = 38.5), with a total of 308 minutes of video available for analysis. Five sessions took place in an inpatient setting, and 3 within an outpatient setting. The characteristics of the patients are displayed in Table 1.

**Instructions and Feedback**

Verbal instructions and feedback were used frequently throughout all observed sessions. Table 2 shows the agreed-upon definitions for each of the key themes. Key themes relating to instruction and feedback are presented below; each subsection presents both quantitative and qualitative findings related to a specific theme.

**Frequency and Timing of Instructions and Feedback**

Instructions were used far more commonly than feedback statements. An average of 76 instructions (IQR = 65.5–79.5) were delivered per treatment session compared with an average of 22 feedback statements (IQR = 16–25.5). These averages equate to approximately one instruction or piece of feedback being given to patients every 14 seconds. Very often, a sequence of instructions would be given successively, prompting the patient to think about several different components of the task, highlighted by the following example (internal focus = blue, external focus = red, unfocused = purple).

Video 5 (patient is practicing walking):

Step back with your right foot, good. Wait, don’t lose...wait. Grow tall, step forwards, good. Step back. And step forward. Good. So just keeping both heels on the floor...OK, that’s quite tricky for you...just...want you just let your hips come back so your weight comes to your back foot, now let your weight go forward to your front foot... . . .

In addition, instructions were commonly repeated by the therapist several times within a short space of time. These repeated instructions tended to occur concurrently with

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**Table 1.**

Characteristics of the Physical Therapists and Patients Who Took Part in the Study

<table>
<thead>
<tr>
<th>Video No.</th>
<th>Setting</th>
<th>Duration of Observation (min)</th>
<th>Physical Therapist's No. of Years Working in Neurological Rehabilitation</th>
<th>Patient Details</th>
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<td>4</td>
<td>NOP</td>
<td>50</td>
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<tr>
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<td>8</td>
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</table>

* CVA = cerebrovascular accident, mRMI = modified Rivermead Mobility Index, ASU = acute stroke unit, SRU = stroke rehabilitation unit, NOP = neurology outpatients, PACS = partial anterior circulatory stroke, ICH = intracerebral hemorrhage.
the patient’s attempts to perform the movement.

**Attentional Focus**

All physical therapists used a combination of internal and external focus statements. The example below, given to a patient who was practicing a sit-to-stand task, demonstrates the use of an internal focus for both feedback and instruction.

Now, just a little point. When you’re standing up, your knees tend to come together [internal focus feedback]. So, when you’re standing up, try and think about your knees coming over your toes [internal focus instruction]. (Video 1)

In this example, internally focused feedback was used to describe the movement problem, and the patients were encouraged to think about how to modify their movement as they repeated the task. In contrast, the following example promotes an external focus, whereby attention was directed toward the functional purpose of the movement. The patient was not told how to move. Although the therapist used the word “want,” the intonation of these sentences indicated an instruction, rather than a question or choice.

So, if you want to stand up [patient stands from wheelchair]. Much better, lovely. OK. And then if you want to come over to the mirror. (Video 2)

Statements of this kind were less common. Where externally focused statements were used, they were typically inexact, as in this example. There were no clear examples of externally focused statements deemed likely to enhance movement accuracy.

Some statements, categorized as having a mixed focus of attention, included both internal and external focused information within the same sentence, for example: “I want you to take your bottom away from the plinth [external focus] by straightening your knees and squeezing here [internal focus].” The frequency of such mixed statements was relatively low (11%).

Figure 1 highlights the distribution of internal, external, and mixed focus statements for each of the observed sessions (ie, for each therapist). On average, 67% of the statements delivered by physical therapists were internally focused, 22% were externally focused, and 11% were of mixed focus.

**Unfocused Statements**

Some statements did not elicit any particular focus of attention and,
therefore, were categorized separately as unfocused statements. These statements were defined as short, concise phrases that served to prompt or encourage an action (eg, “and again,” “keep going”), or to provide encouragement (eg, “good,” “well done”), but that did not refer to any specific aspect of performance. Unfocused statements were typically motivational in nature. The incidence of such statements was high, as shown in Figure 2.

Unfocused statements were used frequently, often in clusters, meaning that a patient would receive a succession of prompts while he or she practiced an activity. The following abstract from video 5 highlights this approach. The patient practiced stepping alongside a table; the therapist provided assistance and used unfocused statements throughout the task.

So step back . . . as if you are going to turn . . . that was lovely, that’s it. Excellent. And step forward, and step back. Good. And step forward, and step back. Good. Wait. Keep it there. Lovely, OK. And release the knee, release the knee. Lovely. And step round. Good. Wait. Good. (Video 5)

Increasing Patient Awareness Through Observation
In all but one of the treatment sessions, therapists stated to the patients that they wanted to observe or analyze their movements. These statements generally were followed by internally focused comments about those observations. In each of the examples below, the therapist stated that she wanted to “look at” or “see” what was happening.

I’m just going to roll your . . . trouser leg up a little bit, just so I can keep an eye on what’s happening with this foot. (Video 4)

So, just without your socks and shoes and your splint on, let’s just see, sort of like, what’s happening with your walking. (Video 5)

Explanatory Information
Physical therapists regularly delivered explanations about what they were observing, or why they were asking patients to perform certain tasks. These statements are important because although they are neither instruction nor feedback, they may lead to an internal focus by drawing the patient’s attention to his or her body. Such statements were identified in all 8 videos; examples are given below.

That wobbling is just showing me that you’re trying to work that knee—which is good. (Video 1)

Because you go into what we call extensor tone . . . your muscles are really tight in that extended position, so it’s really hard for you to bend your knee through. (Video 7)

Encouraging Conscious Thought in Relation to Performance
Asking a patient to “think about” his or her performance also was common. These statements related either to general performance (eg, “If you want to stand up again . . . think about how you’re standing up.”) or to a specific component of that movement (eg, “Thinking about controlling that knee, I’m gonna get you to step your other foot up.”). Similar phrases also were used to bring the elements of the movement together, again prompting conscious thought.

Try to remember the elements that I’ve said to you. Keep your foot on the floor and stand up. So think about what you’re doing. (Video 4)

Right, OK, so try and remember all those things. So push off with that leg. (Video 3)

Nonverbal Instruction
Although the frequency of verbal instructions was clearly high, the use of nonverbal methods in instructing patients was low. Six of the 8 therapists used demonstration at some point, although the actual number of occurrences was very low (X=1.75 occurrences per treatment session). Demonstration was always used prior to the patient attempting the task and was always combined with a verbal instruction. No other themes relating to nonverbal instruction were identified.

Nonverbal Feedback
Two types of nonverbal feedback were identified: external cues and physical handling. External cues were used by 4 therapists; these cues included markers on the floor (tar-
Therapists used physical handling to some degree in all of the observed sessions. From analyzing videos alone, it is not possible to establish the role that handling may play in directing movement, delivering feedback, or directing focus of attention. However, it was evident that when physical therapists were “hands on,” this approach was typically accompanied by verbal instruction or feedback of some form.

Discussion
This is the first study to explore focus of attention in gait rehabilitation poststroke. Observational methods were used to examine how attentional focus of the patient is directed while practicing gait rehabilitation activities. In line with other studies that have demonstrated high volumes of therapist-led communication during stroke rehabilitation,20,21,24 physical therapists were observed to use verbal communication frequently throughout the treatment sessions, typically during the practice of rehabilitation tasks. Most of this communication constituted instructions or feedback, with a clear trend toward the use of internally focused information, prompting patients to think about bow they are moving. Unfocused statements (eg, “good”) also were used regularly, and patients were frequently encouraged to “think about” their performance. These findings closely replicate those from a previous study investigating focus of attention during arm rehabilitation poststroke.21

Although experimental research into the benefits of an external focus of attention during the rehabilitation of individuals with stroke is lacking, studies involving computer-based serial reaction time tasks have shown that individuals with stroke can continue to learn unintentionally (ie, without specific instruction) and that providing declarative knowledge about the task they are attempting to perform can actually degrade learning.30–35 It has been hypothesized that this detrimental impact on learning is due, in part, to the increased demand that explicit information places on working memory, as well as due to the loss of automaticity that results from tasks being broken down into their component parts.5,36 It is feasible that the frequent use of internally focused instruction, as observed during this study, may lead to a reduction in movement automaticity.

The benefits of an external focus are explained further by the conceptualization proposed by Wulf and colleagues, who also emphasized the importance of automaticity. The constrained action hypothesis7 suggests that when participants are prompted to focus on their specific movements (internal focus), they may constrain or interfere with automatic control processes that normally would regulate movement, whereas if attention is focussed toward the movement effect (external focus), the motor system is able to more naturally self-organize.37 By adopting an external focus, unconscious or automatic processes control the movement, resulting in more effective performance and subsequently learning.38 Recent work by Masters and colleagues39,40 proposed that people with stroke may be more susceptible to skill breakdown in the presence of internally focused information, due, in part, to factors such as increased self-consciousness, slow information processing, and reduced attentional capacity,41 all of which may increase the tendency for individuals to consciously control movement. This increased awareness of movement may be initiated or exacerbated in circumstances where evaluation of performance is likely.42 for example, when therapists evaluate a person’s movement, comment on the quality of movement, or draw attention to specific impairments. Such practices were observed frequently during this research and could mean that patients are not given sufficient opportunity to demonstrate what they can achieve themselves, hindering performance and learning.20

Although this study focused primarily on attentional focus, the relationship to attentional capacity also warrants consideration. Not only did physical therapists tend to use internally focused statements, but they were used in high quantities. Patients, therefore, were given a large amount of information to process while practicing activities. Attention capacity limits may be reduced in people with neurological damage, meaning that this volume of information may be problematic. Indeed, dual-tasking studies have repeatedly shown that performance efficacy can decrease when individuals perform motor and cognitive tasks concurrently.43–47 Although the processing of verbal instructions and feedback requires cognitive resource, it is important to note that this type of verbal interaction is fundamentally different from the experimental paradigms used during dual-tasking studies, where the cognitive task is generally unrelated to the task of walking.46 Therefore, further research is needed to determine whether the findings from dual-tasking studies are replicated in circumstances where the cognitive activity is related directly to the task of walking (ie, with the participant being prompted to think about and correct the walking pattern).
Internal and External Focus of Attention During Gait Re-Education

Limitations

Although 308 minutes of video data were generated and the observations were analyzed in detail, the actual number of observed treatment sessions was relatively small (N=8). In addition, physical therapists were recruited from 2 geographically close sites. Therefore, the observations made may have resulted from local practice trends and may not be generalizable to wider physical therapist practice.

Direct observation carries a number of specific limitations, which are outlined in the literature.25,26 It is possible that the therapists and patients observed in this study altered their behavior in the presence of the researcher, creating observer bias. For example, the use of verbal communication may have been exaggerated as a result of physical therapists inadvertently attempting to demonstrate to the researcher what they were doing and why. Although observer bias cannot be completely eliminated, robust measures, as outlined in the “Method” section of this article, were taken to reduce this effect.

Finally, by utilizing direct observation alone as a means of data collection, interpretation is limited to a fairly descriptive approach, and understanding why therapists behaved as they did is not accessible. In future work, it would be useful to explore participants’ perceptions of the treatment sessions to gain their perspective of the observed behaviors and the reasons why they are utilized.

Clinical Implications

As studies within sports have consistently shown differences in learning relative to focus of attention,5,14,15,17,48–50 it may be important for therapists to begin to recognize that the focus of attention derived from their communication with patients may have an impact on performance and learning. Indeed, the evidence to support the benefits of an external focus of attention among healthy populations is compelling.6,10,12,15,17,51,52 Although many of these studies investigated discrete object manipulation tasks (eg, hitting a ball), some demonstrated the relative benefits of an external focus of attention during performance of whole-body tasks such as long jumping16 or treadmill running.17 These findings suggest that the type of motor task being practiced is not necessarily important, and the findings, therefore, may be equally applicable to tasks such as gait rehabilitation.

Future research needs to consider whether instructing patients “how to” move, as observed during this study, is conducive to learning.5 In particular, clinically relevant studies are needed to examine how focus of attention can be directed during rehabilitation and its impact on clinical outcomes. The impact of internal versus external focus of attention during gait rehabilitation poststroke will be tested in the next phase of this research.

Ms Johnson and Professor Burridge provided concept/idea/research design. All authors provided writing. Ms Johnson provided data collection and project management. Ms Johnson and Dr Demain provided data analysis. Professor Burridge and Dr Demain provided consultation (including review of manuscript before submission). The authors thank the patients and physical therapists who kindly agreed to take part in this study. The authors also like thank Hayden Kirk (Consultant Physiotherapist in Neurology) and Anna Gould (Neurological Physiotherapist) for giving their expertise and time to support the data analysis.

An oral presentation of the data from this phase of the research was given at the UK Stroke Forum Conference; November 29–December 1, 2011; Glasgow, United Kingdom.

References

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Appendix.
Example of a Completed Analysis Matrix

Each column represents a 30-second block of video. Incidences of instruction or feedback were identified and counted as a tally. For example, between 1 minute 30 seconds and 2 minutes, the therapist used 1 internally focused feedback statement and 3 unfocused statements. Nonverbal behaviors were recorded if they occurred at any point within the 30-second block. In this example, a mirror was used (external focus–visual) for 1 minute 30 seconds, and the therapist was “hands on” for 5 minutes.

![Analysis Matrix: Focus of Attention](image)

“Squeeze your bottom and straighten your knee”

“Look up at the window”

“Think about bringing your weight over”

“That’s better knee control”

“Good”

“Well done”

“Keep going”

“You walked further that time, you went as far as the chair”
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