

Interactive Full Body Exercise Experience

for People Affected with Ankylosing Spondylitis

Guide : Prof. Girish Dalvi

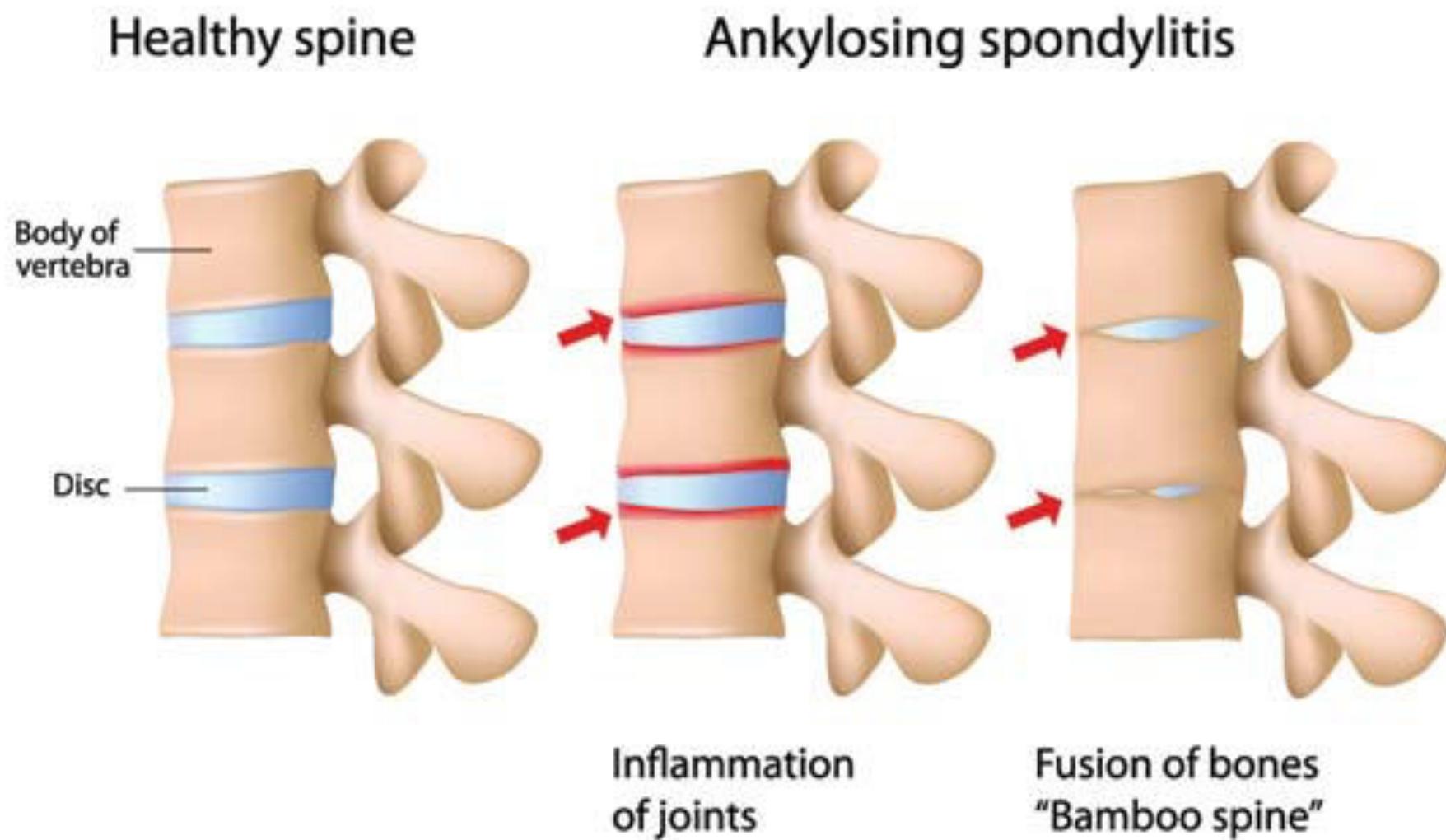
Jayati Bandyopadhyay 146330004

What is Ankylosing Spondylitis

DEFINITION

Ankylose - become stiffened or united.

- Inflammatory rheumatic disease.
- Mainly affects the axial skeleton.
- Joint margins gradually ossify.

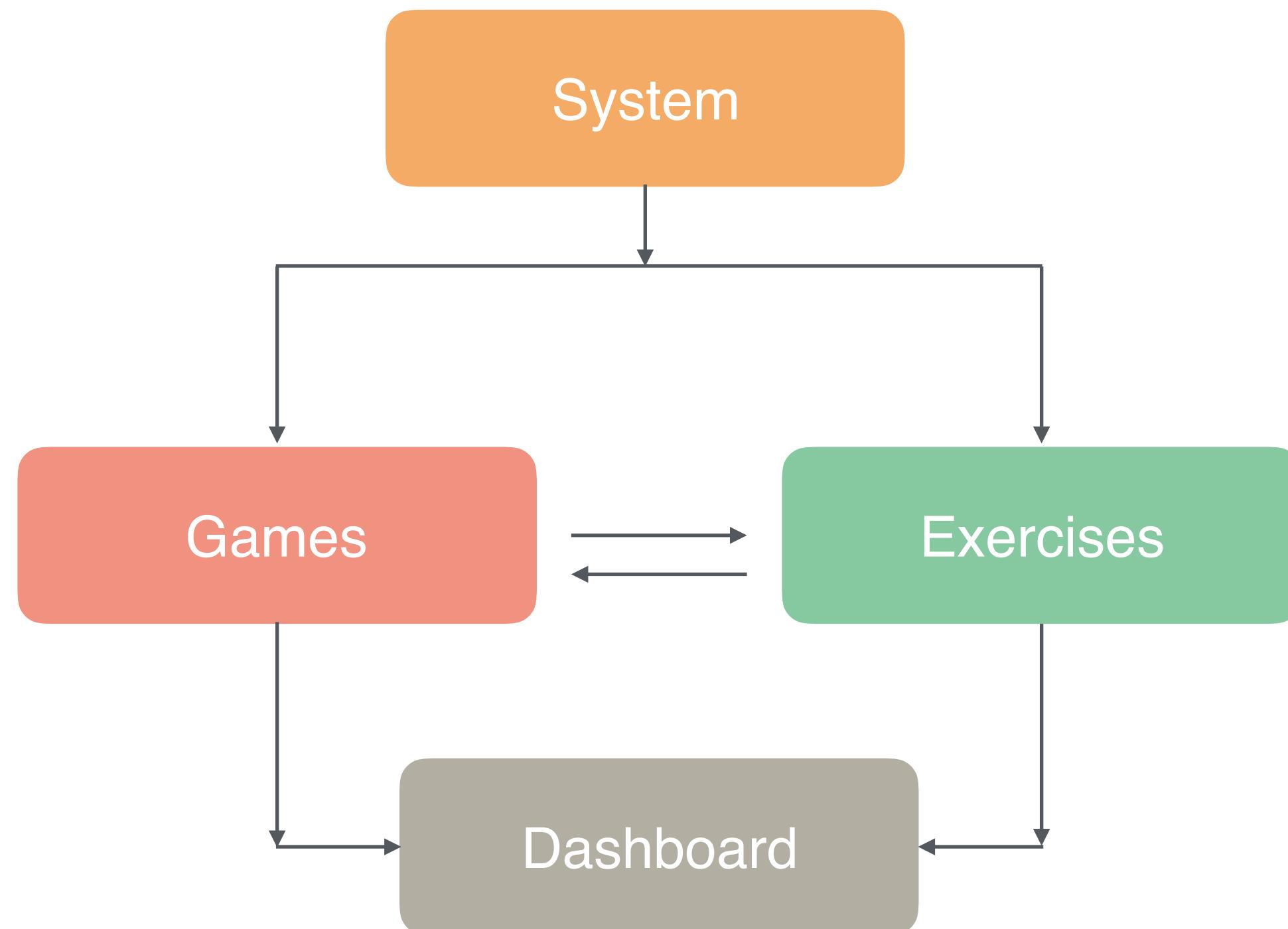


Recap

FEATURES

- Feedback and tracking.
- Repeat and Redo.
- Disease knowledge.
- Intrinsic Motivation and gamifying exercises.
- Switch between exercise and games.
- Social media integration.
- Remote supervision.

SYSTEM DESIGN

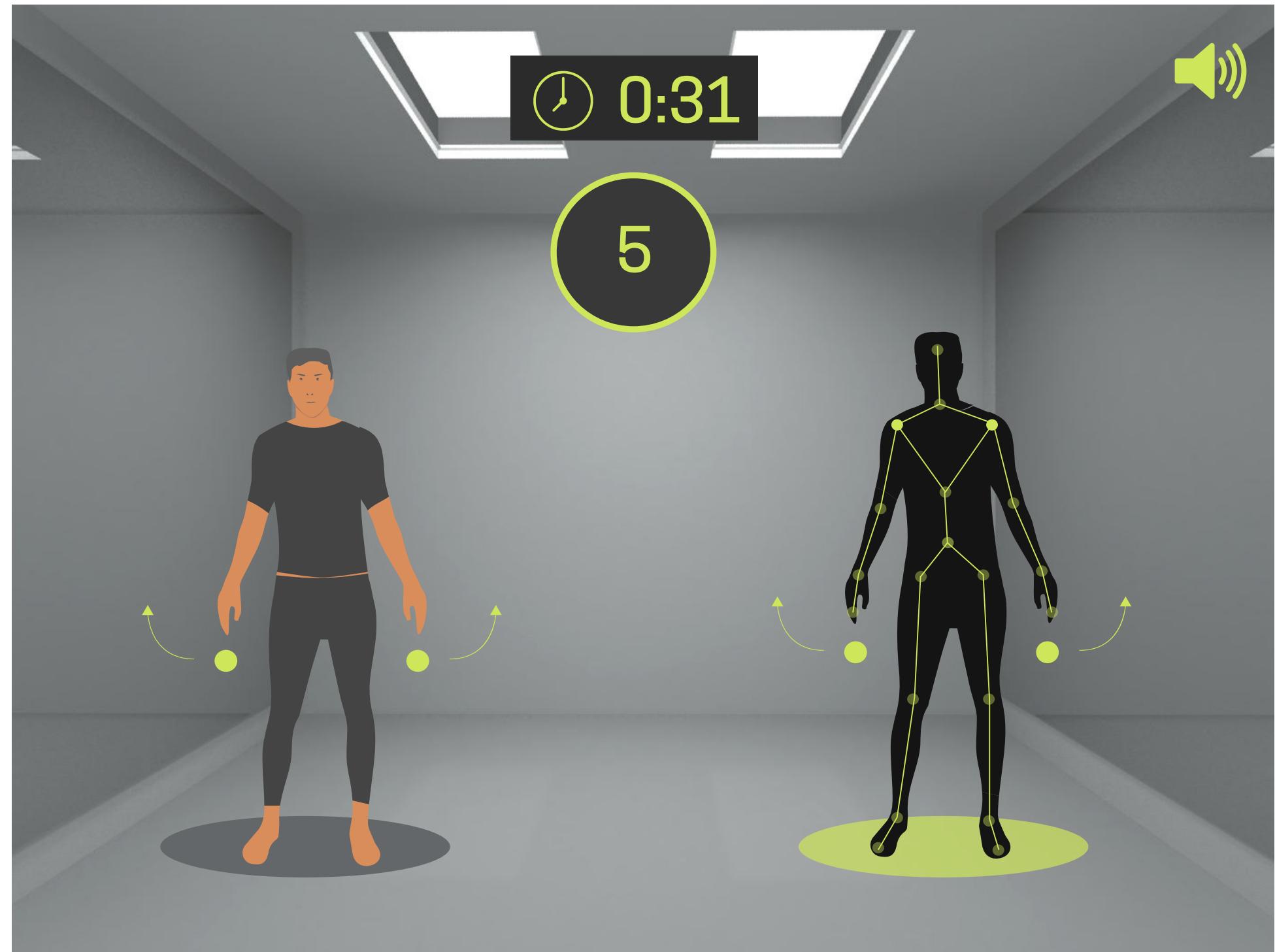


Recap

Exercise Regime : Demonstration + Tracking + Feedback

Game : ShapeUp (Posture matching level)

- Implemented and evaluated core loop of Exercise Regime and posture level of Game.



Exercise Regime



Game

Previous Feedback & Incorporated Changes

Feedback :

Exercise Regime :

- Visual design not appropriate for patients.
- The system flow across a longer duration of time.
- No evidence of user testing.

Changes :

Exercise Regime :

- User journey and scenarios.
- Remote Supervision by therapist.
- Improved visual design and branding.
- User testing (patients and therapist).

Game :

- ShapeUp does not look like a game.
- Details of levels missing.
- No evidence of user testing.

Game :

- Different difficulty levels of ShapeUp.
- Different gameplay with increased abstraction.
- User testing for ShapeUp and patient feedback on new ideas.

अन्

— to live or to breathe.

Suffix root in Sanskrit.

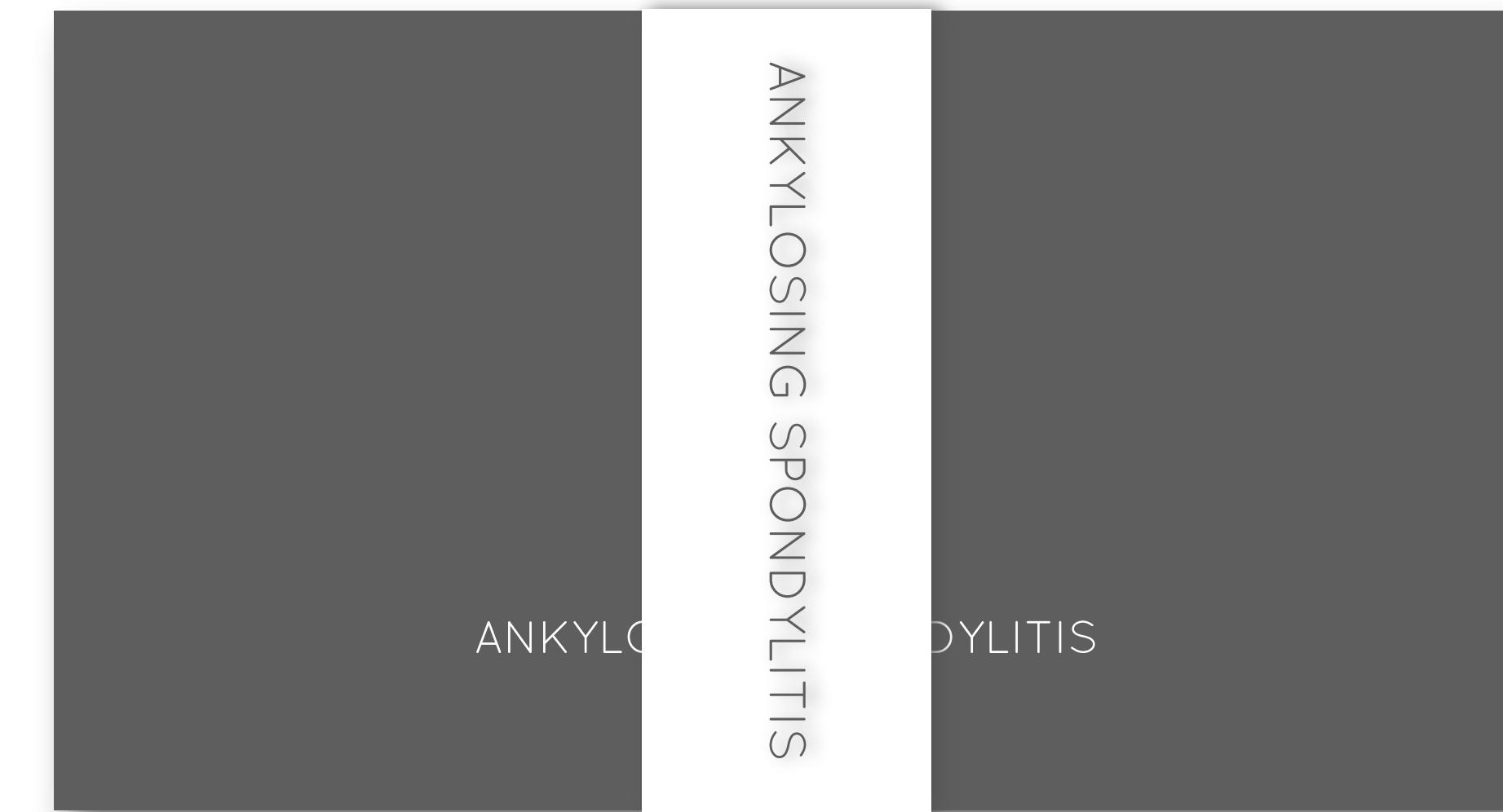
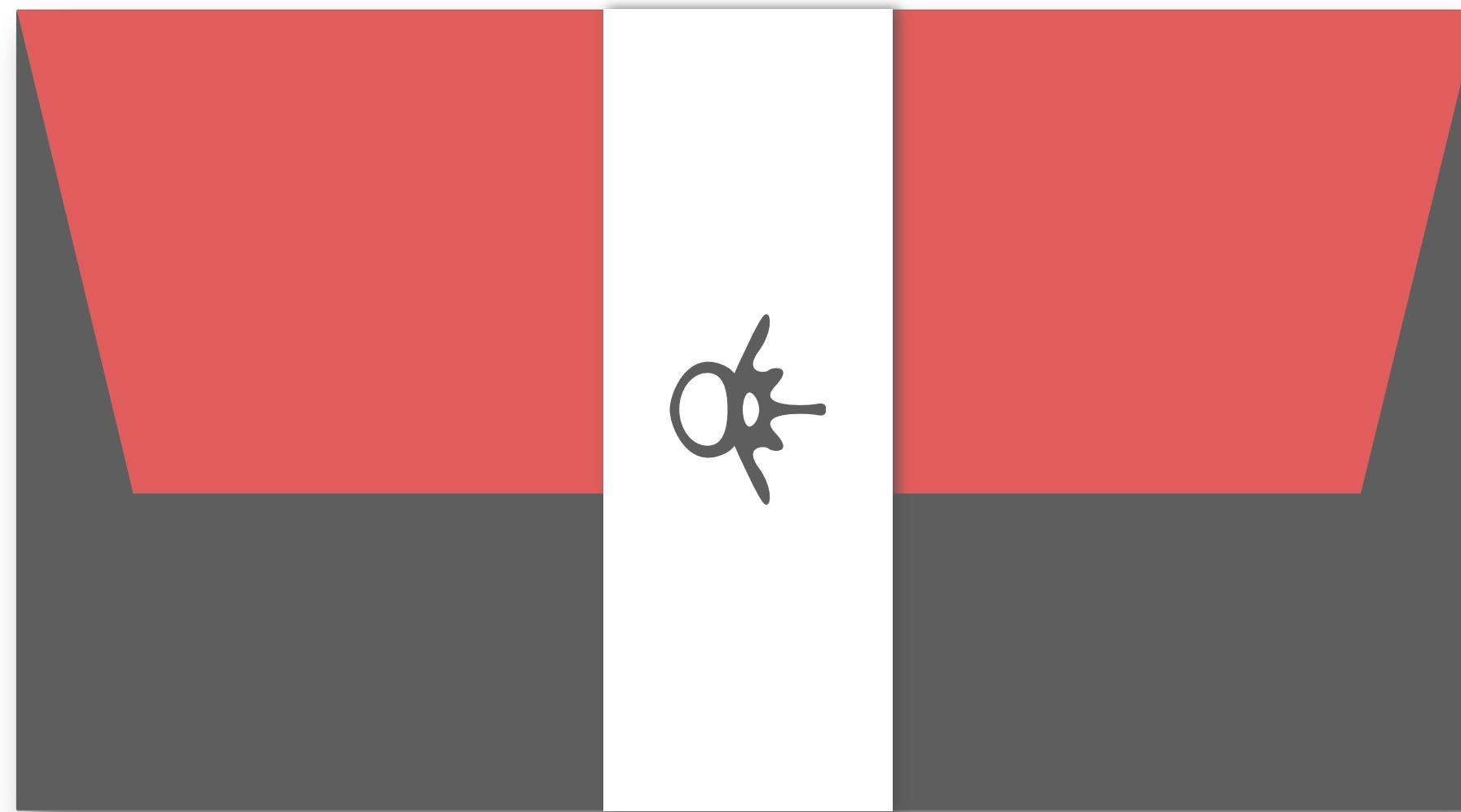


Inspiration : Most affected joint - Axial Skeleton

USER JOURNEY

Current Scenario

- Patients have started registering in social media groups for Ankylosing Spondylitis.
- Members of these groups have started getting Rheumatologists and Orthopaedic doctors on board.
- Active members have started awareness creation about disease, benefits of exercise and diet.



It starts with an envelope.



Doctors hand over the envelope to newly diagnosed patients.

Already diagnosed patients can download the link posted on social media groups by active members.



Instruction Manual

Required Hardware :

1. Laptop or Desktop (Windows or Mac)
2. Power Adapter
3. Kinect Sensor (XBOX 360)

You can refer to the vendor details mentioned in the letter to procure the hardware.

1

2

3

A green light will glow on the sensor if the connection is successfully established.

Connect the white male connector of the power adapter to an USB port of your laptop or desktop.

Connect the orange male connector of the sensor (XBOX 360) with the female orange connector of the power adapter.

Letter

- Patient and therapist details.
- Vendor details.
- Link / QR code to download the application.

Instruction Manual

- Connecting hardware and laptop.

Badge

- Colour coded based on severity.
- Awareness for non-patient groups.





Letter

- Patient and therapist details.
- Vendor details.
- Link / QR code to download the application.

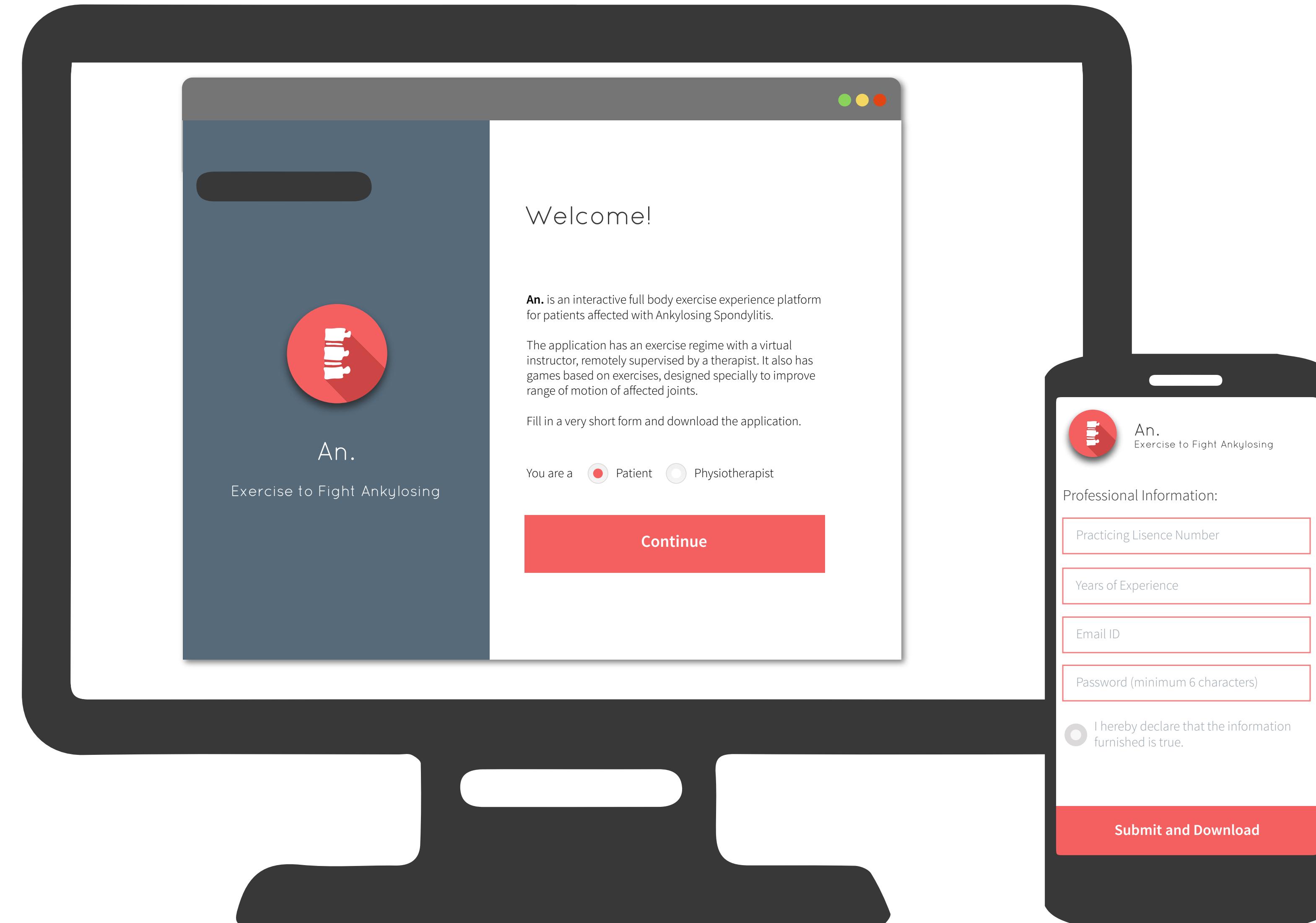
Instruction Manual

- Connecting hardware and laptop.

Badge

- Colour coded based on severity.
- Awareness for non-patient groups.







An.

Exercise to Fight Ankylosing

Welcome!

An. is an interactive full body exercise experience platform for patients affected with Ankylosing Spondylitis.

The application has an exercise regime with a virtual instructor, remotely supervised by a therapist. It also has games based on exercises, designed specially to improve range of motion of affected joints.

Fill in a very short form and download the application.

You are a



Patient



Physiotherapist

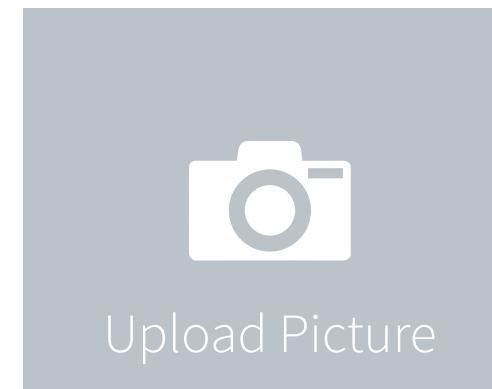
Continue



An.

Exercise to Fight Ankylosing

Personal Information:



This picture will be used as your profile picture and will be visible only to the physiotherapist assigned to you.

Full Name

Email ID

Age

Gender

City

State

Disease Information:

Diagnosed in year, Eg. 2003

Disease Severity



Last severe pain history (approx.)



Your occupation requires physical activity :



Yes



No



Sometimes

This is a desktop application for Windows and Mac.

Submit and Download



An.

Exercise to Fight Ankylosing

Personal Information:

Full Name

Age

Gender



City

State



Professional Information:

Practicing Liscence Number

Years of Experience

Email ID

Password (minimum 6 characters)

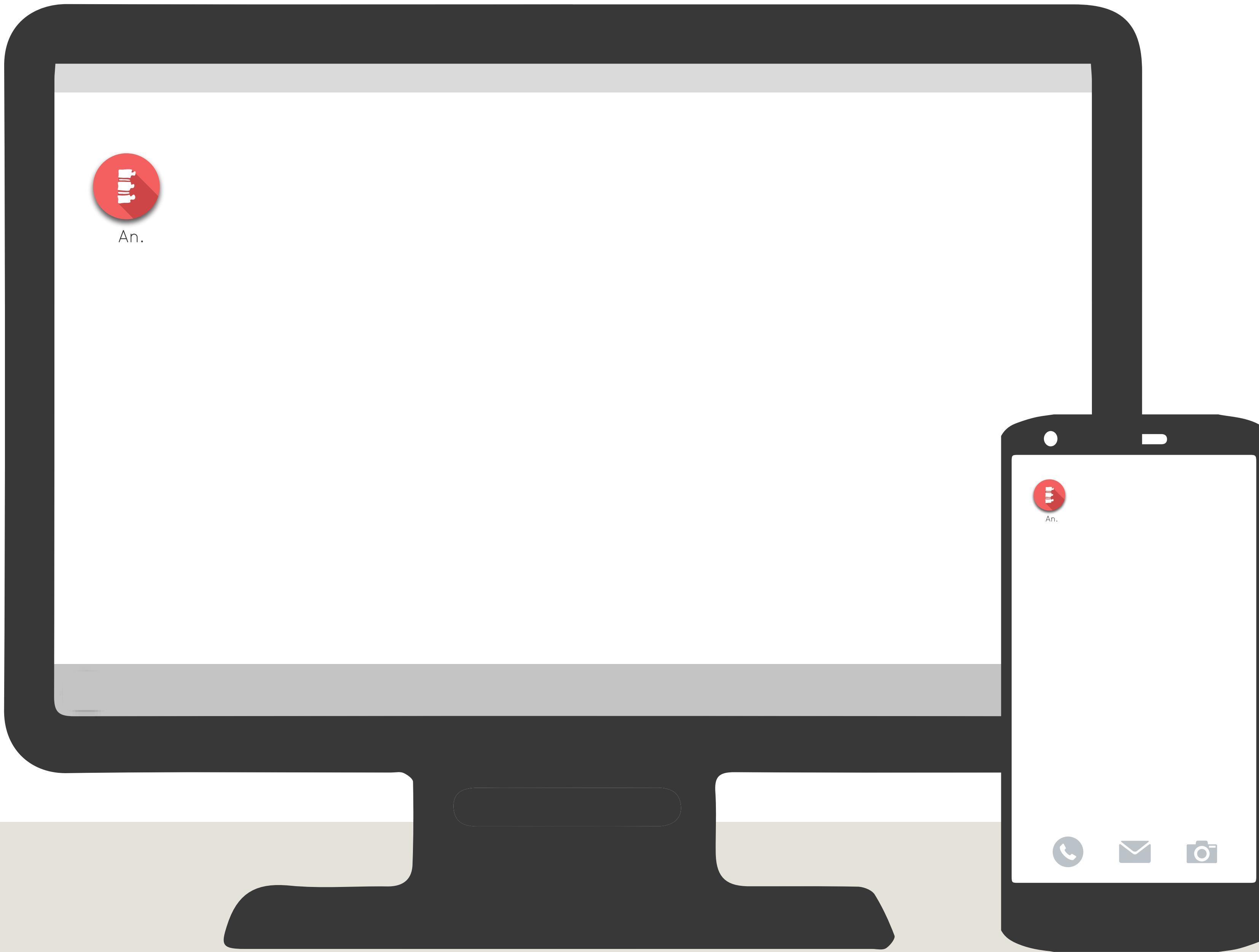


I hereby declare that the information furnished is true.

Submit and Download

This is a mobile application.

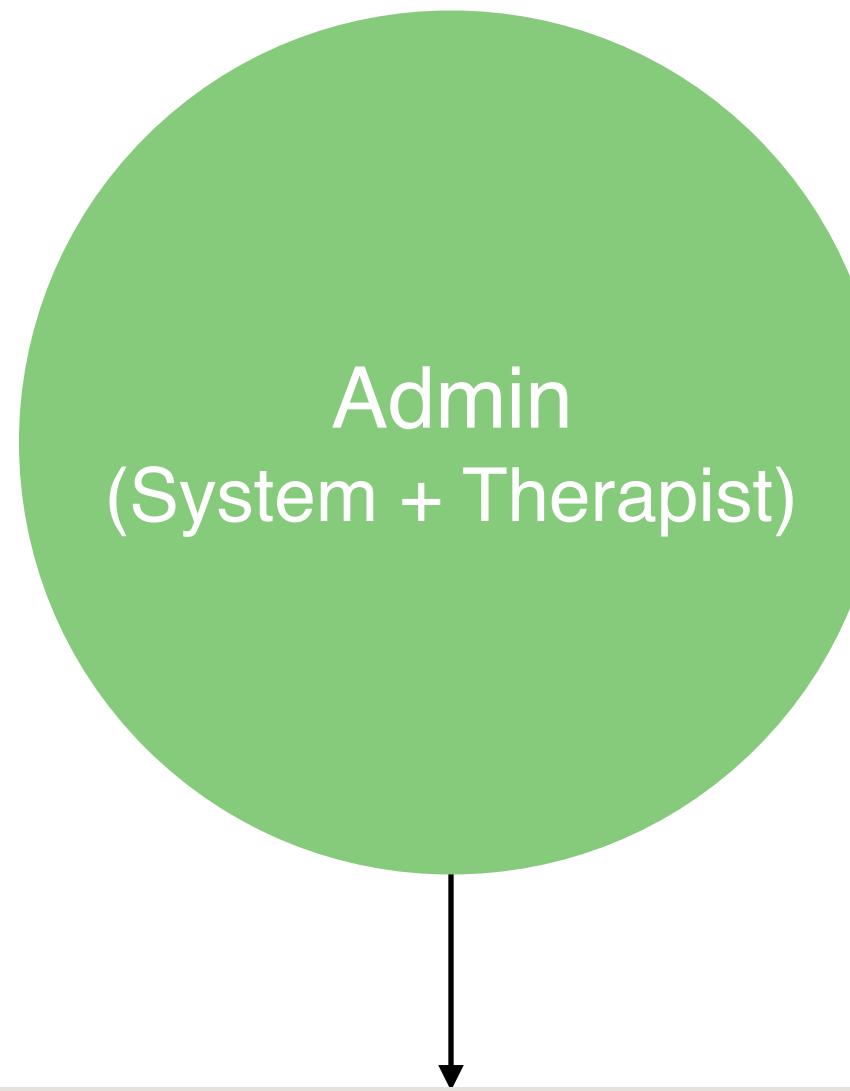
Mail downloadable link to the given email id



The Network

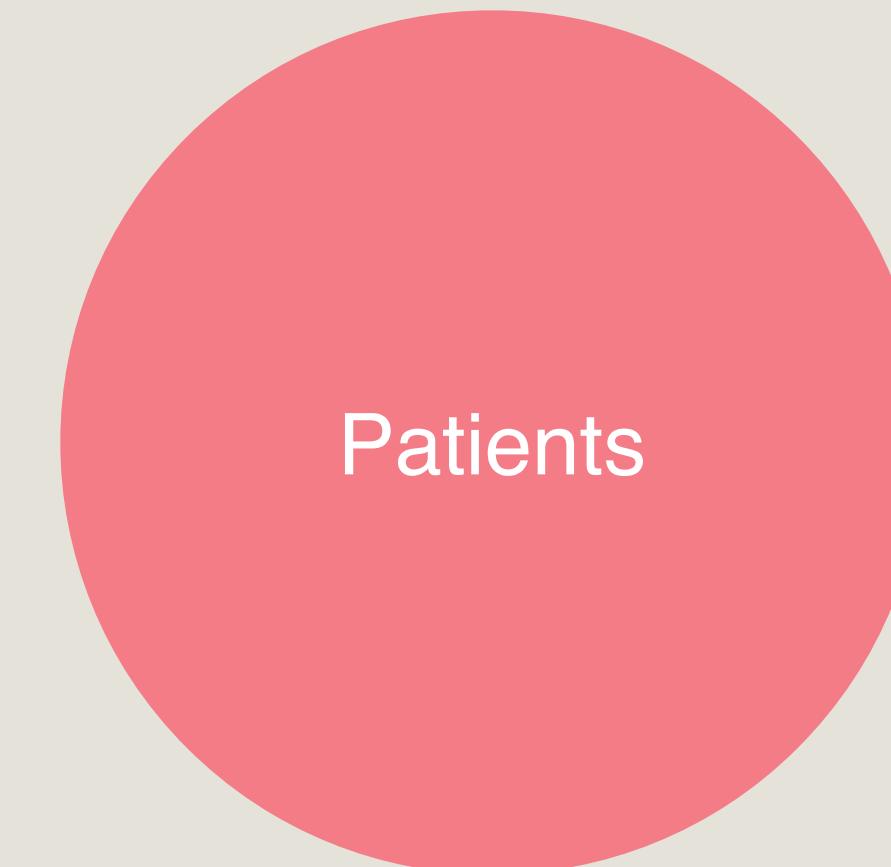
System Admin

- Moderates therapist entry.
- Renumeration model of therapists.
- Rental model of patients.



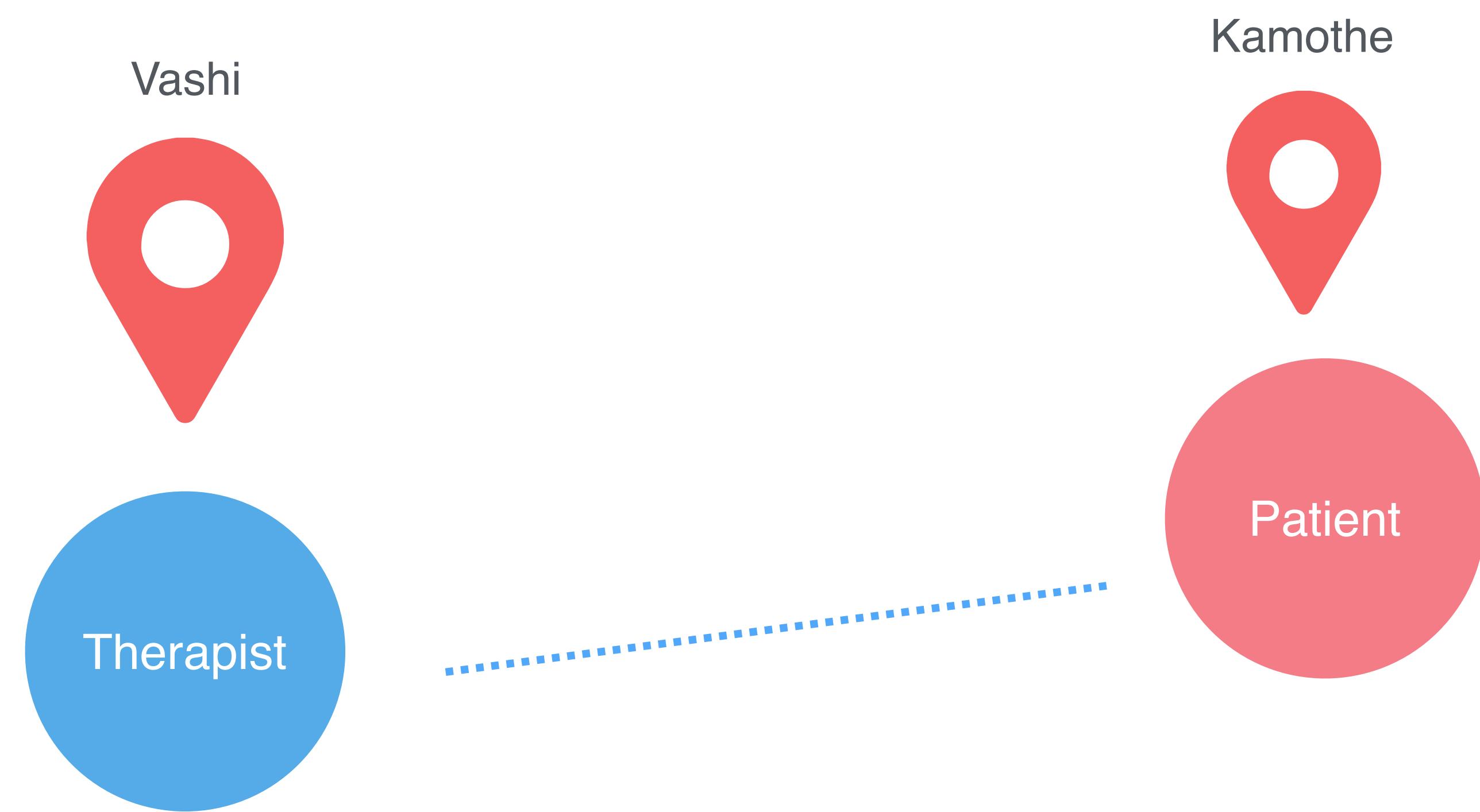
Therapist Admin

- Content generation.
- Auto mode algorithm improvisation.

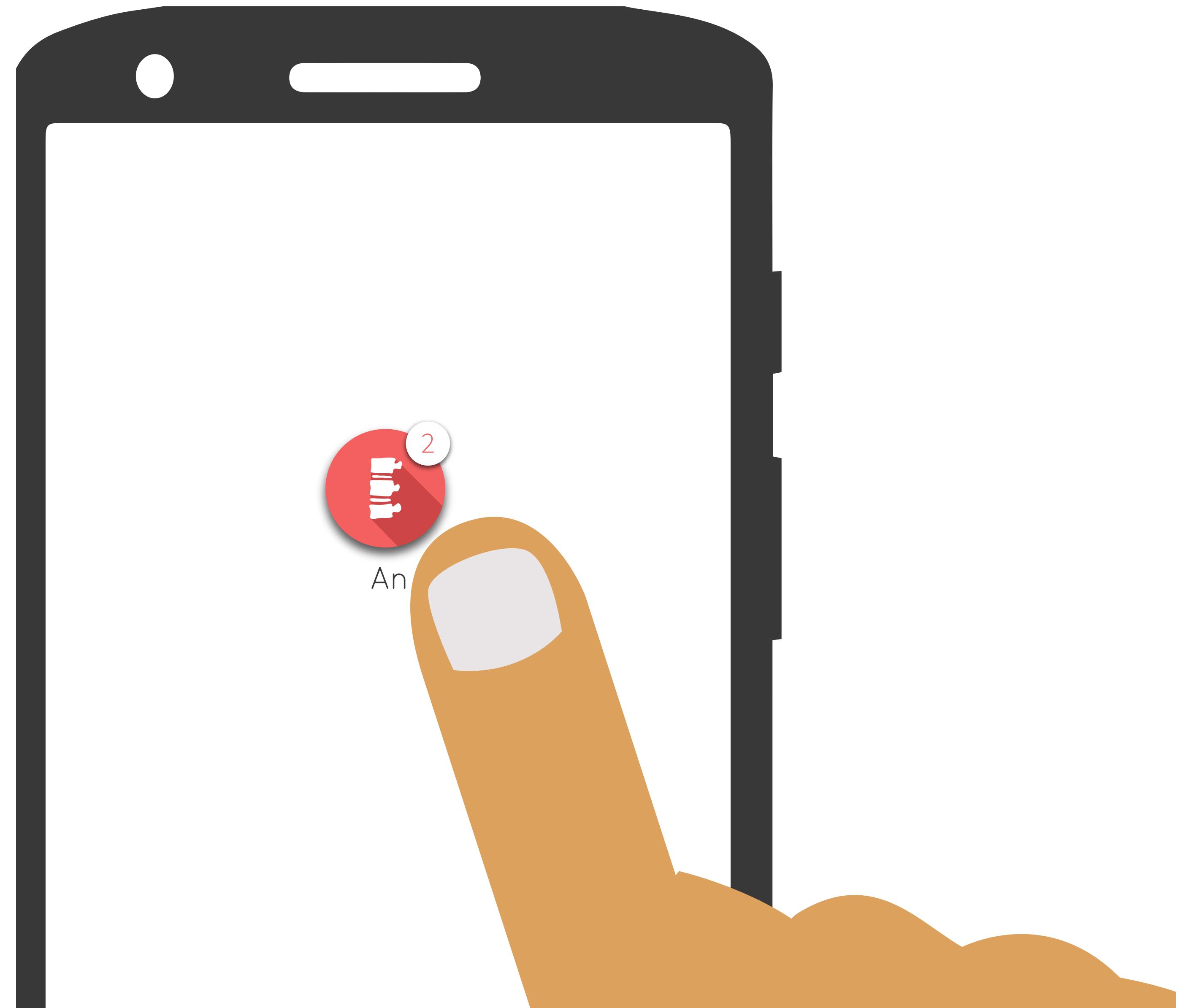


Mapping of therapist and patients - Auto location based mapping

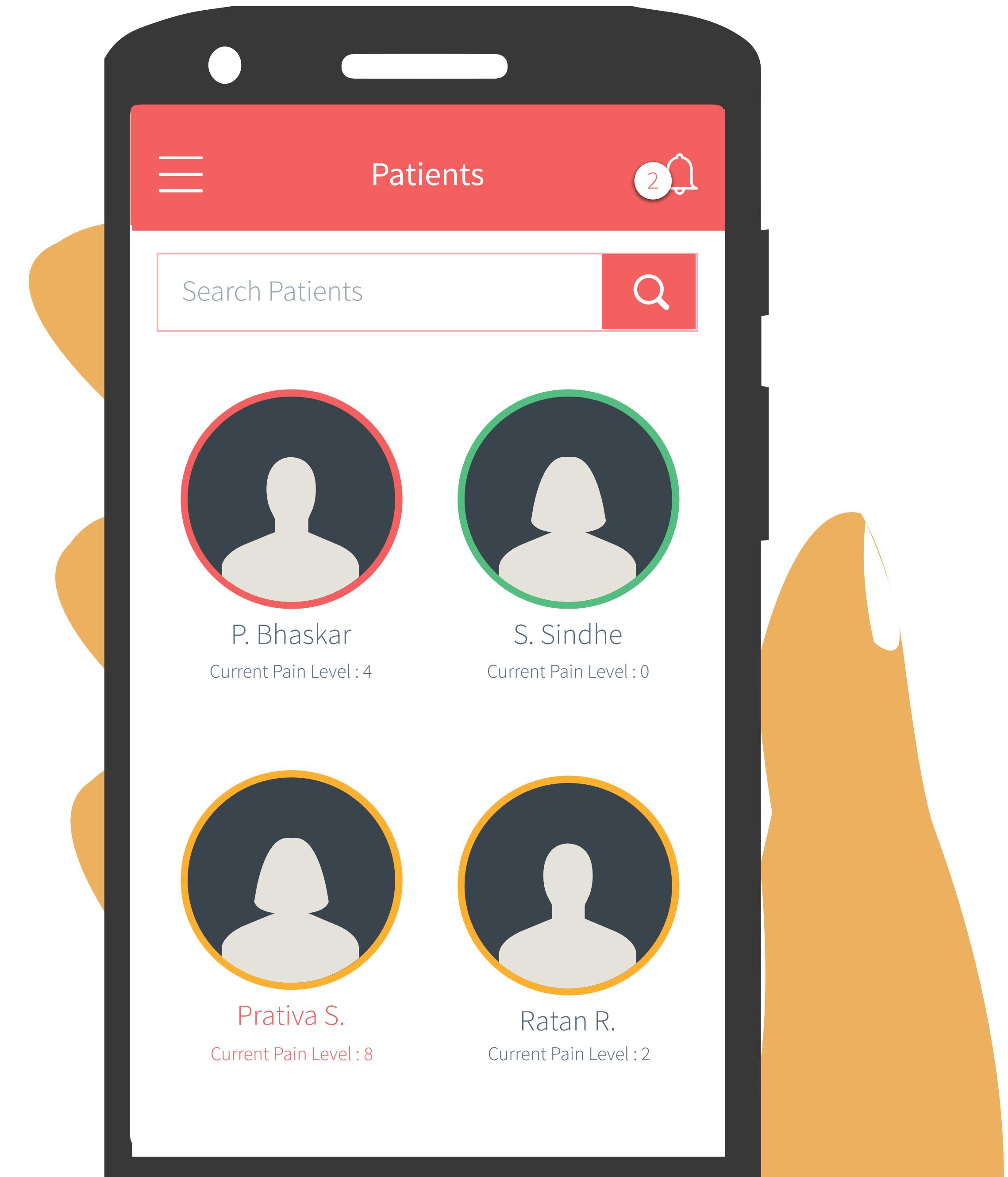




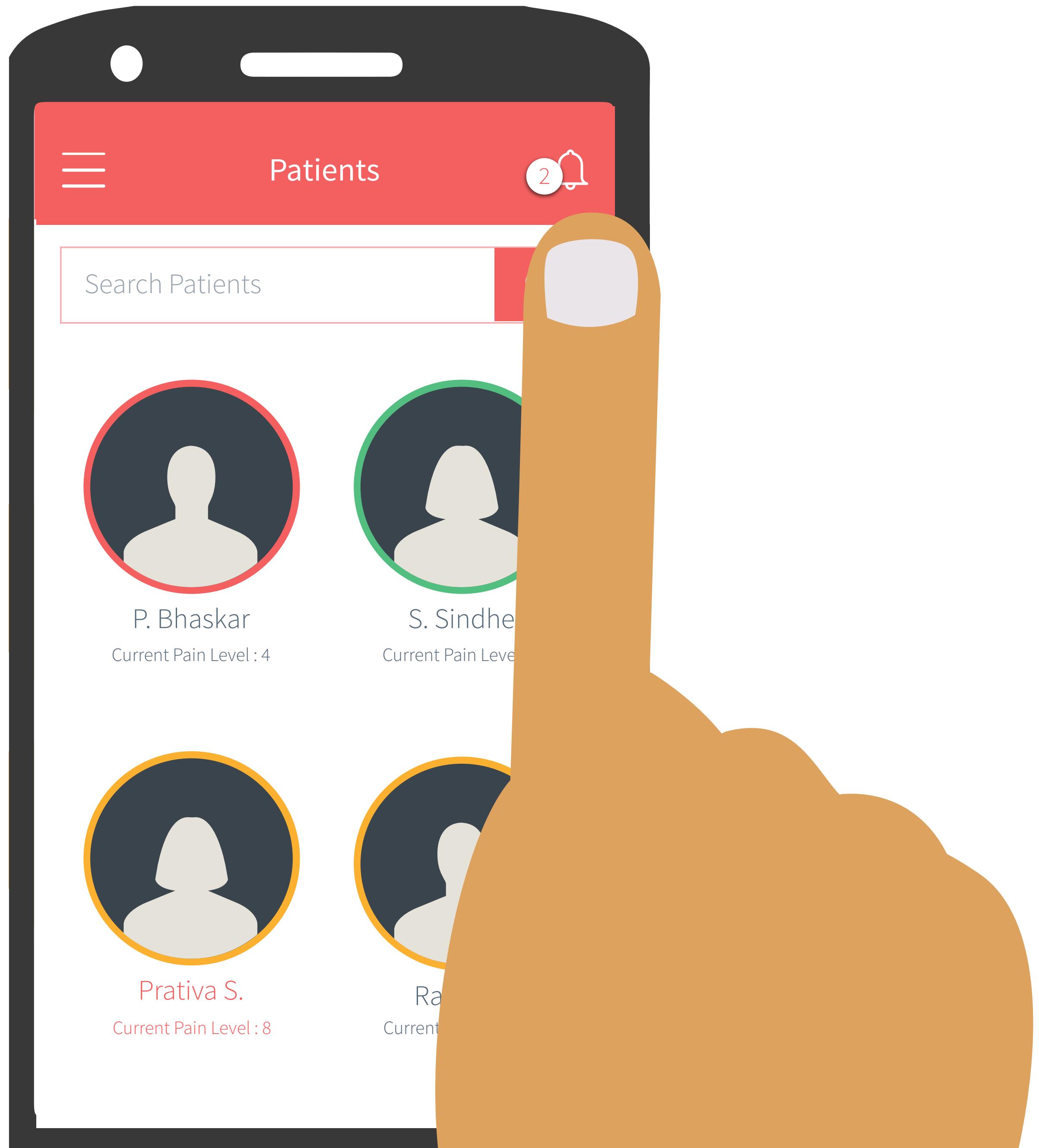
Physiotherapist



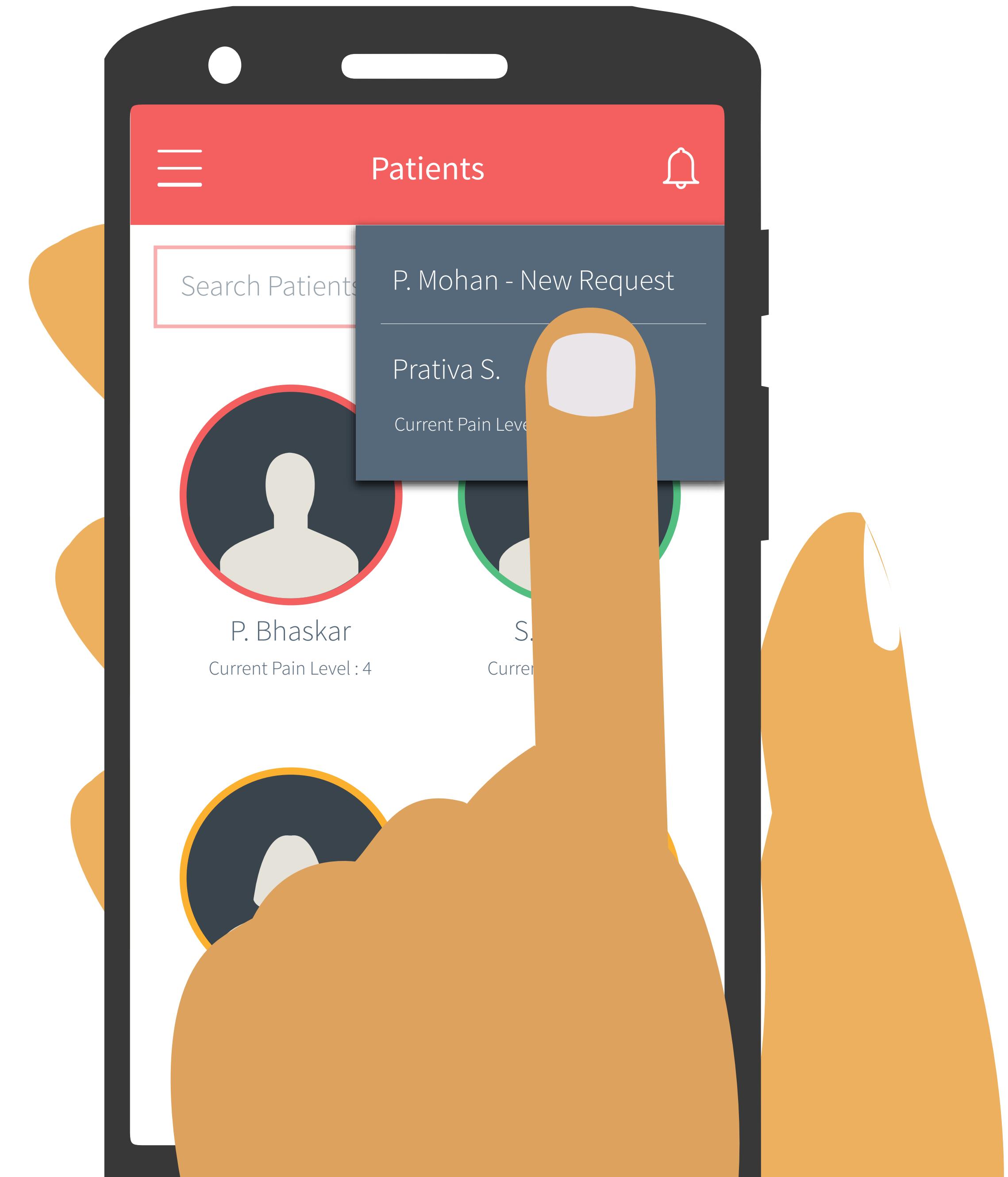
Physiotherapist



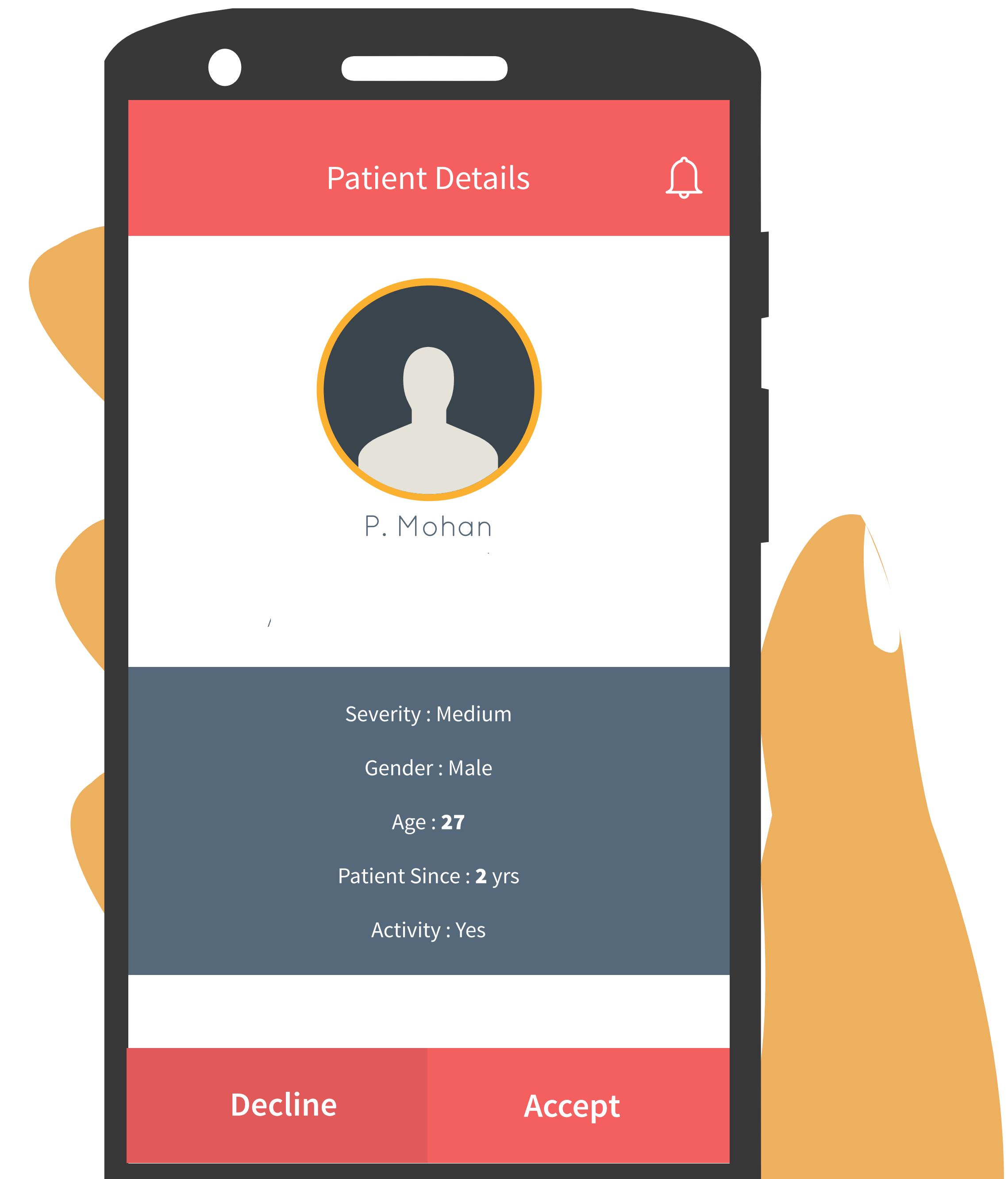
Physiotherapist



Physiotherapist



Physiotherapist



Physiotherapist

P. Mohan

Severity : Medium

Gender : Male

Age : **27**

Patient Since : **2** yrs

Activity : Yes

Decline

Acc

Physiotherapist

< Patient Details Ⓝ



P. Mohan
Patient ID: 1234567890

Severity : Medium
Gender : Male
Age : 27
Patient Since : 2 yrs
Activity : Yes

Exercises Report

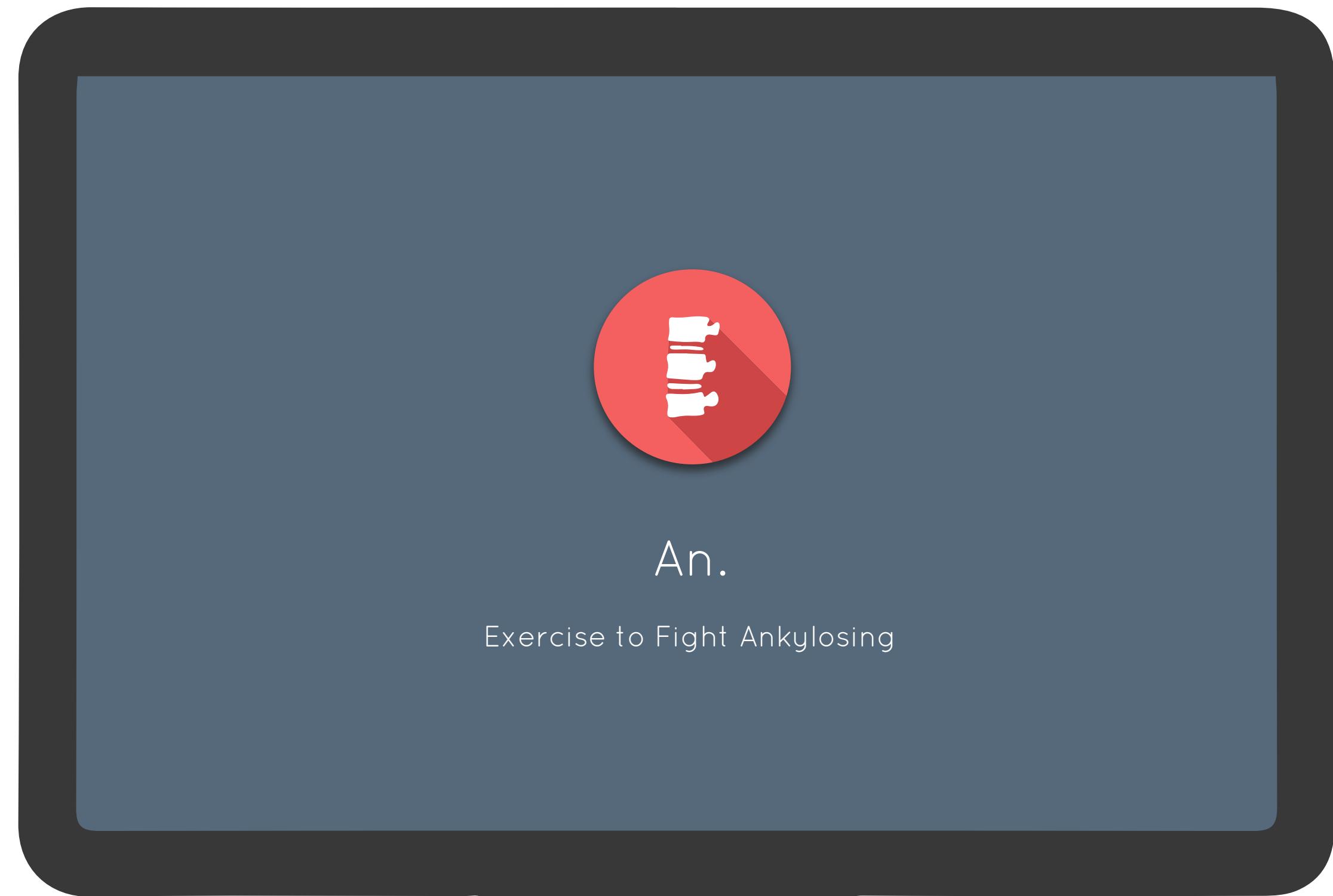
1st time patient



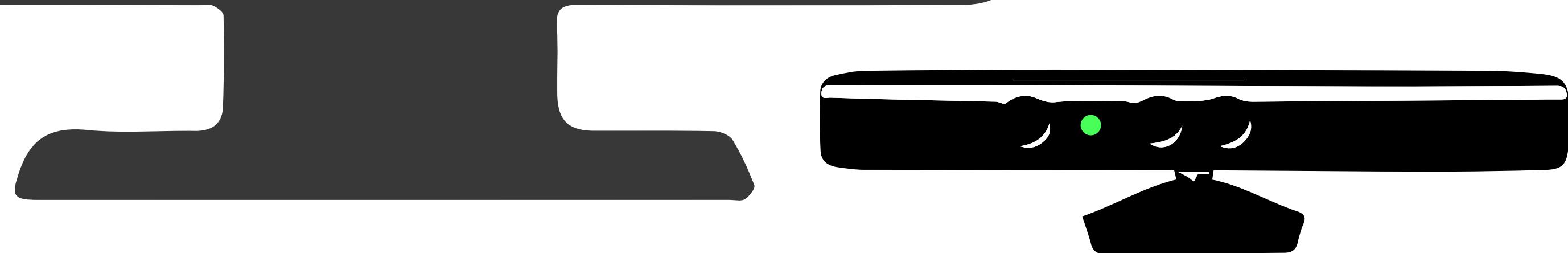
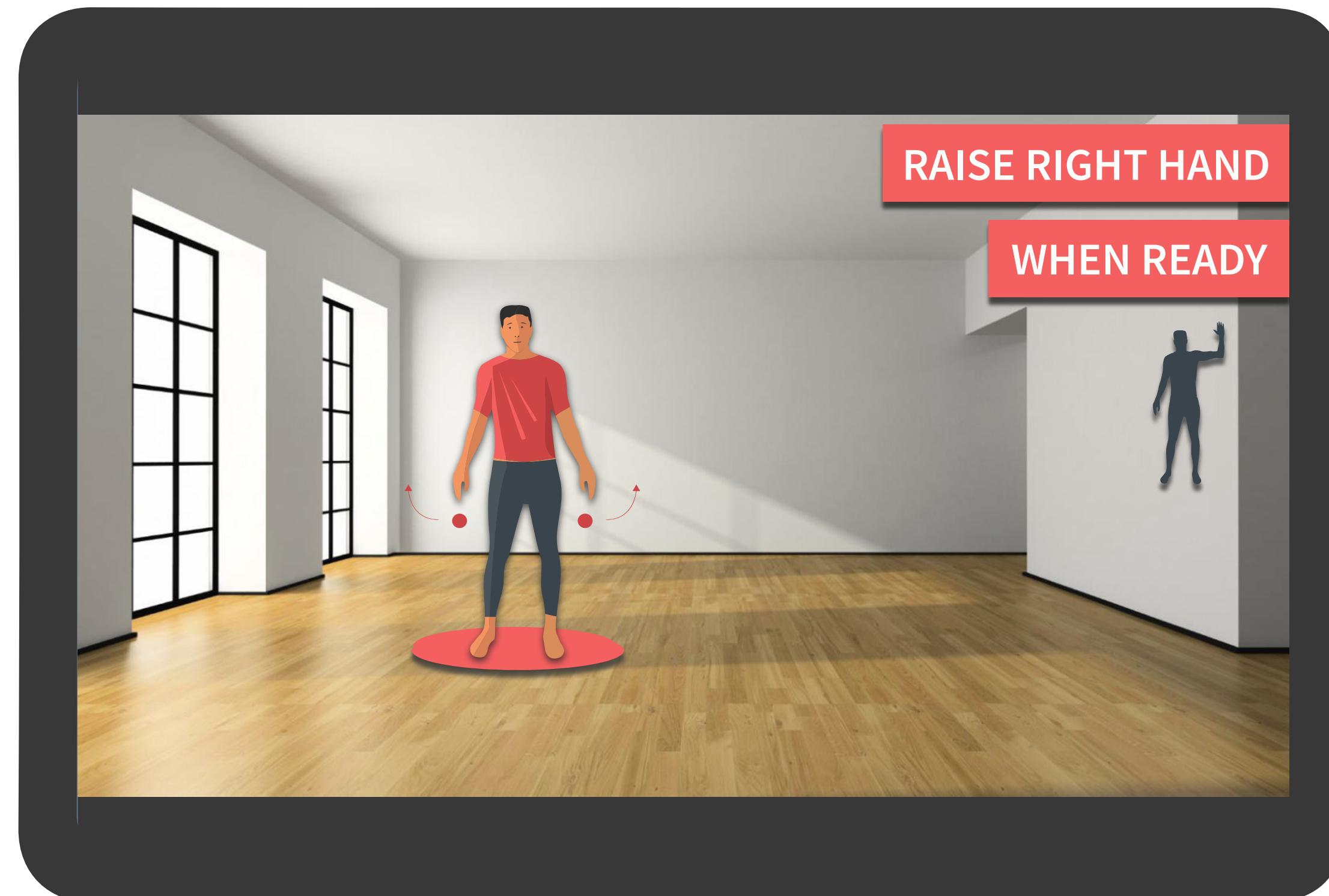


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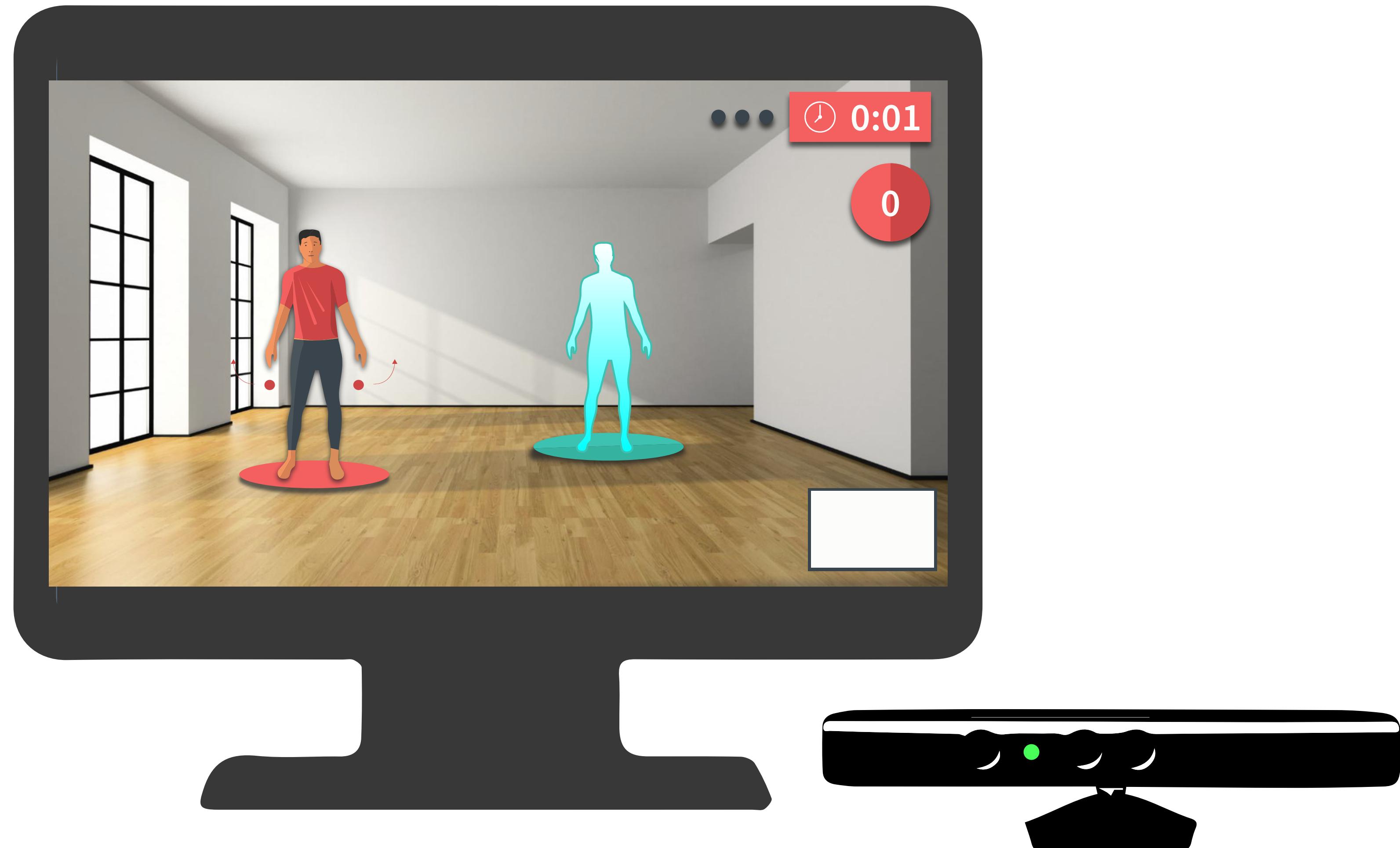




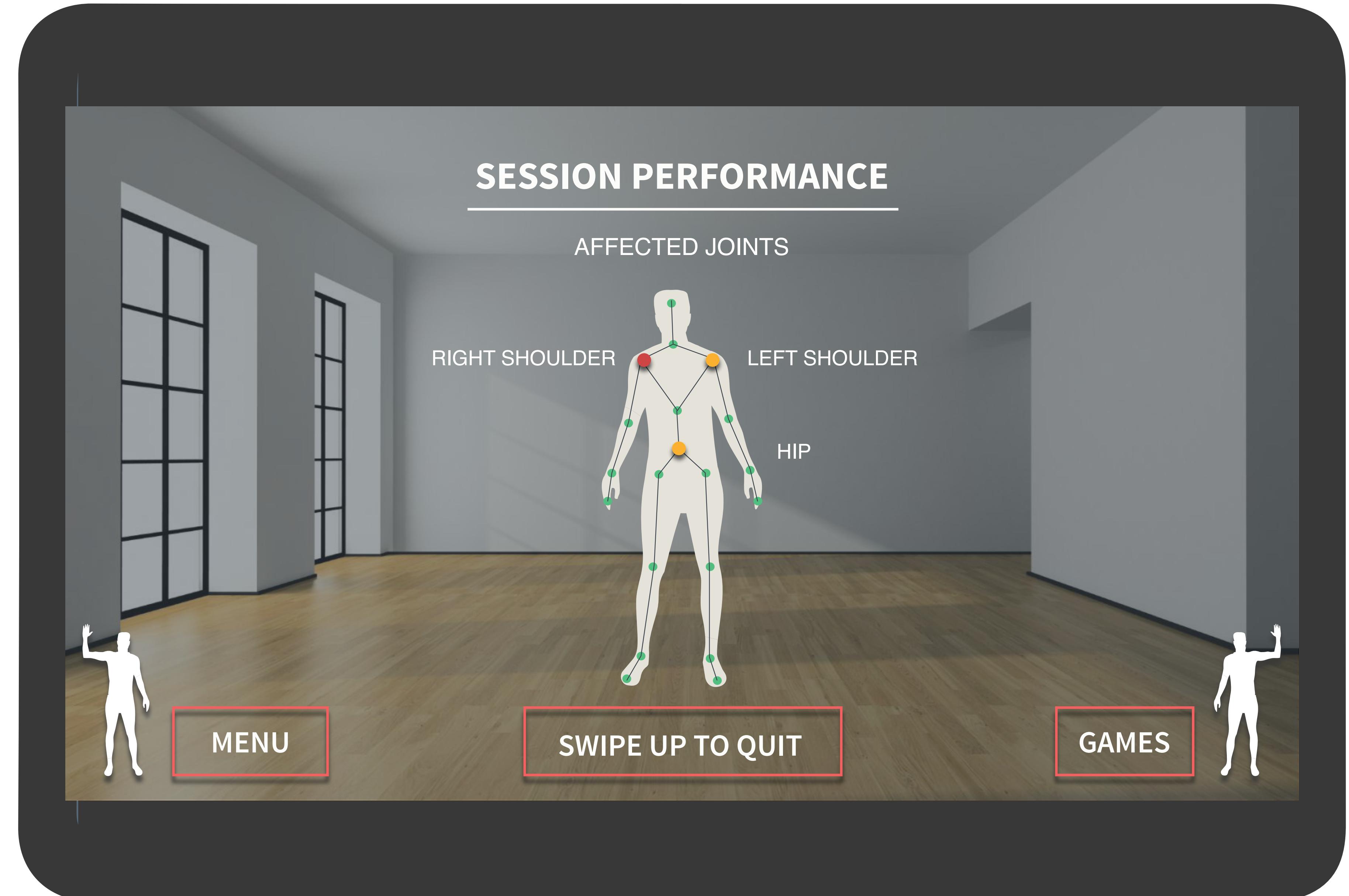
Calibration Session



Calibration Session



Calibration Session



Calibration Session

SESSION PERFORMANCE

Let us start working on your
left and right shoulders from tomorrow!



MENU

SWIPE UP TO QUIT



GAMES

Physiotherapist



Patient Details



P. Mohan

Current Pain Level : 0

Affected Joints : Shoulder, Hip

Severity : Medium

Gender : Male

Age : 27

Patient Since : 2 yrs

Activity : Yes

Exercises

Report

Physiotherapist



P. Mohan

Current Pain Level : 0

Affected Joints : Shoulder, Hip

Severity : Medium

Gender : Male

Age : 27

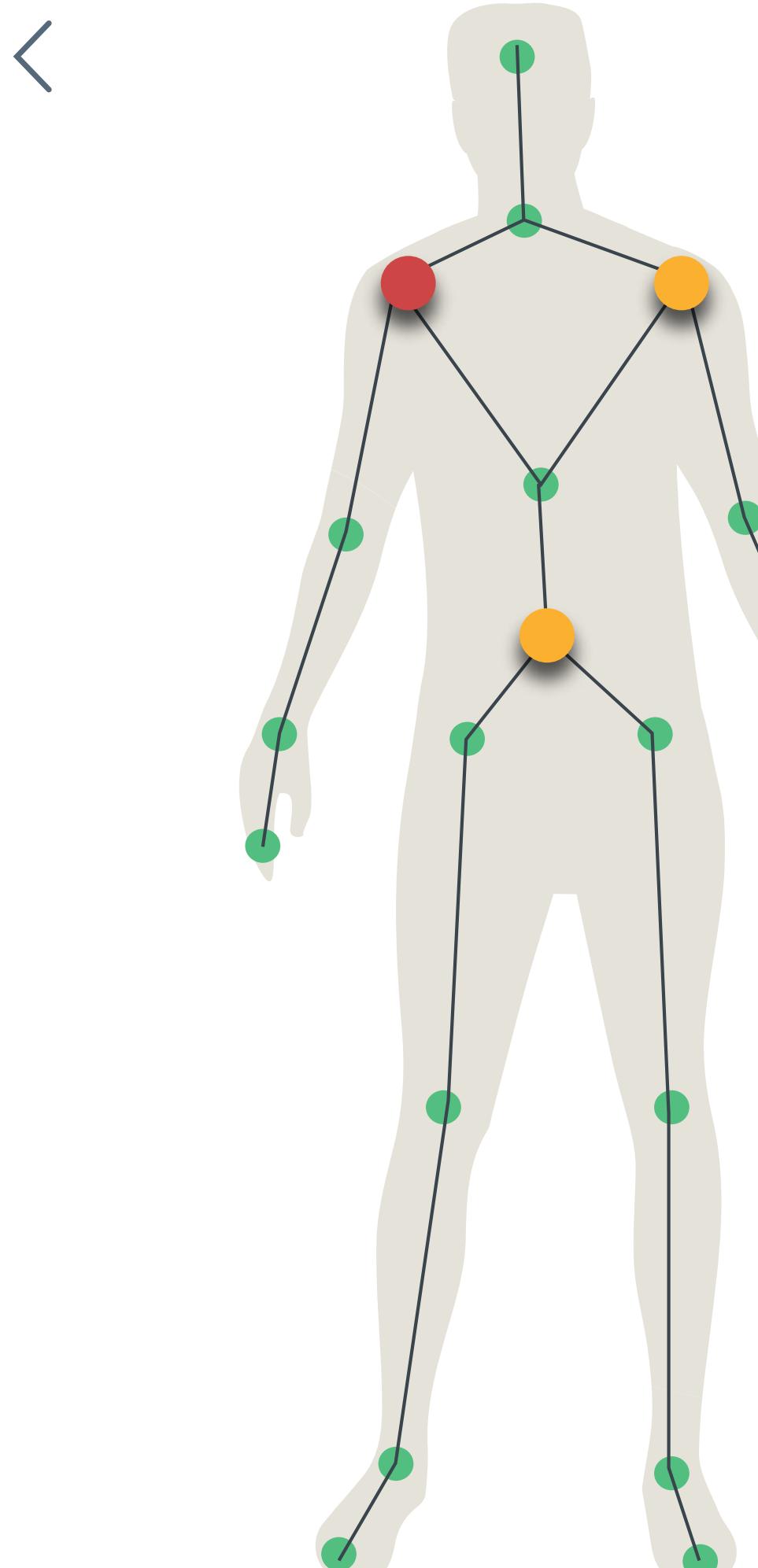
Patient Since : 2 yrs

Activity : Yes

Exercises

Report

Physiotherapist

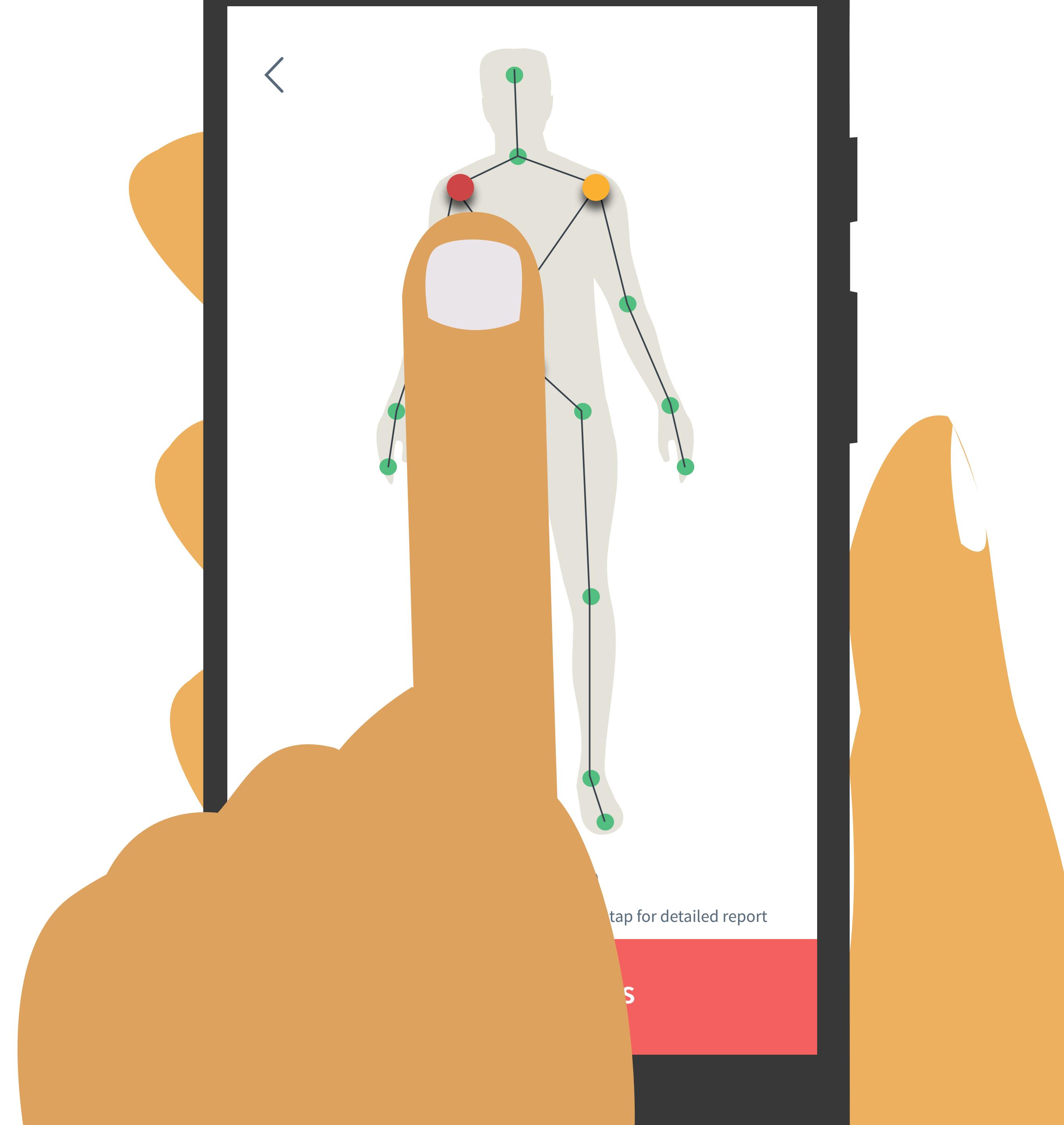


Current Pain Level : 0

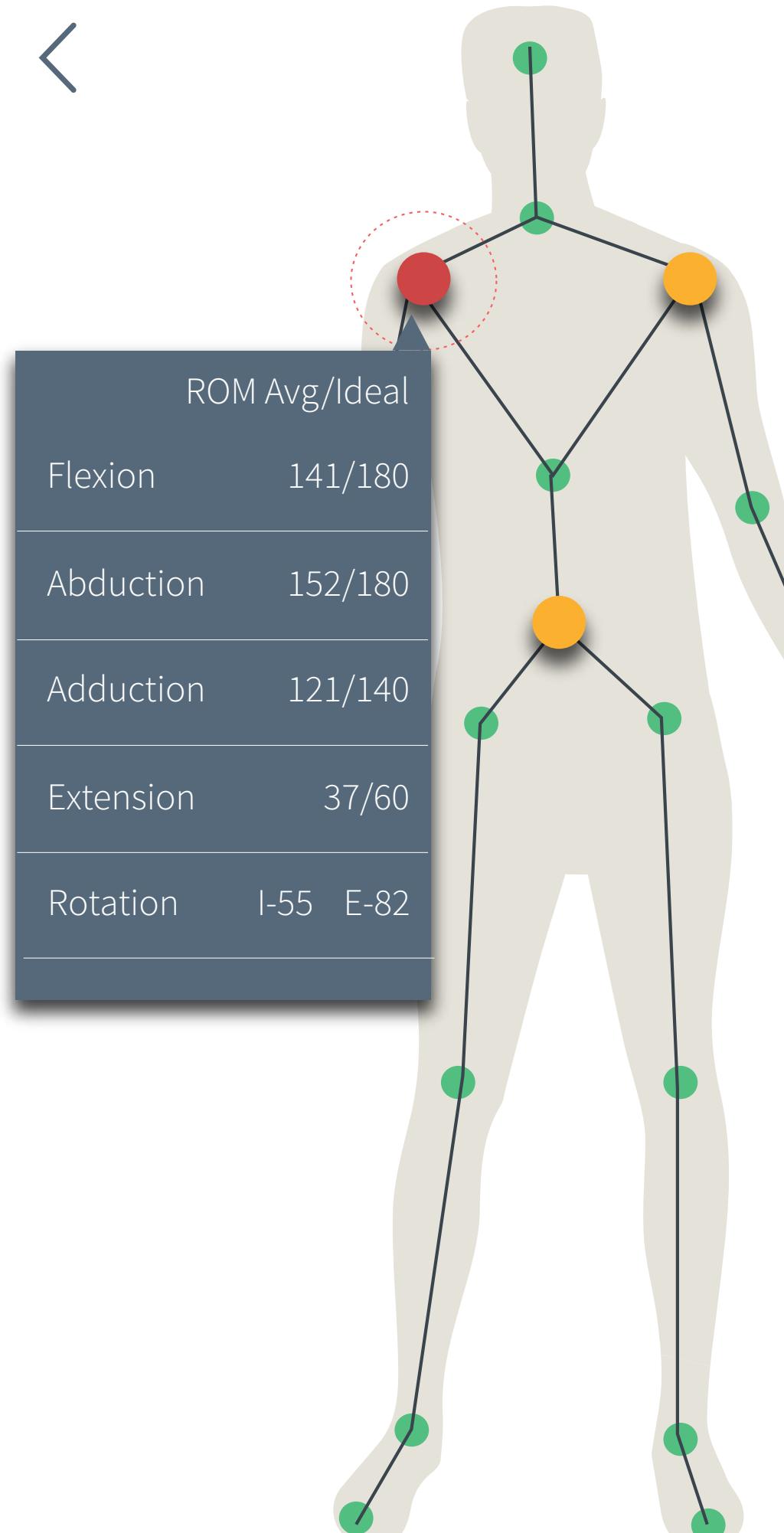
Tap on each joint to view quick report, double tap for detailed report

Assign Exercises

Physiotherapist

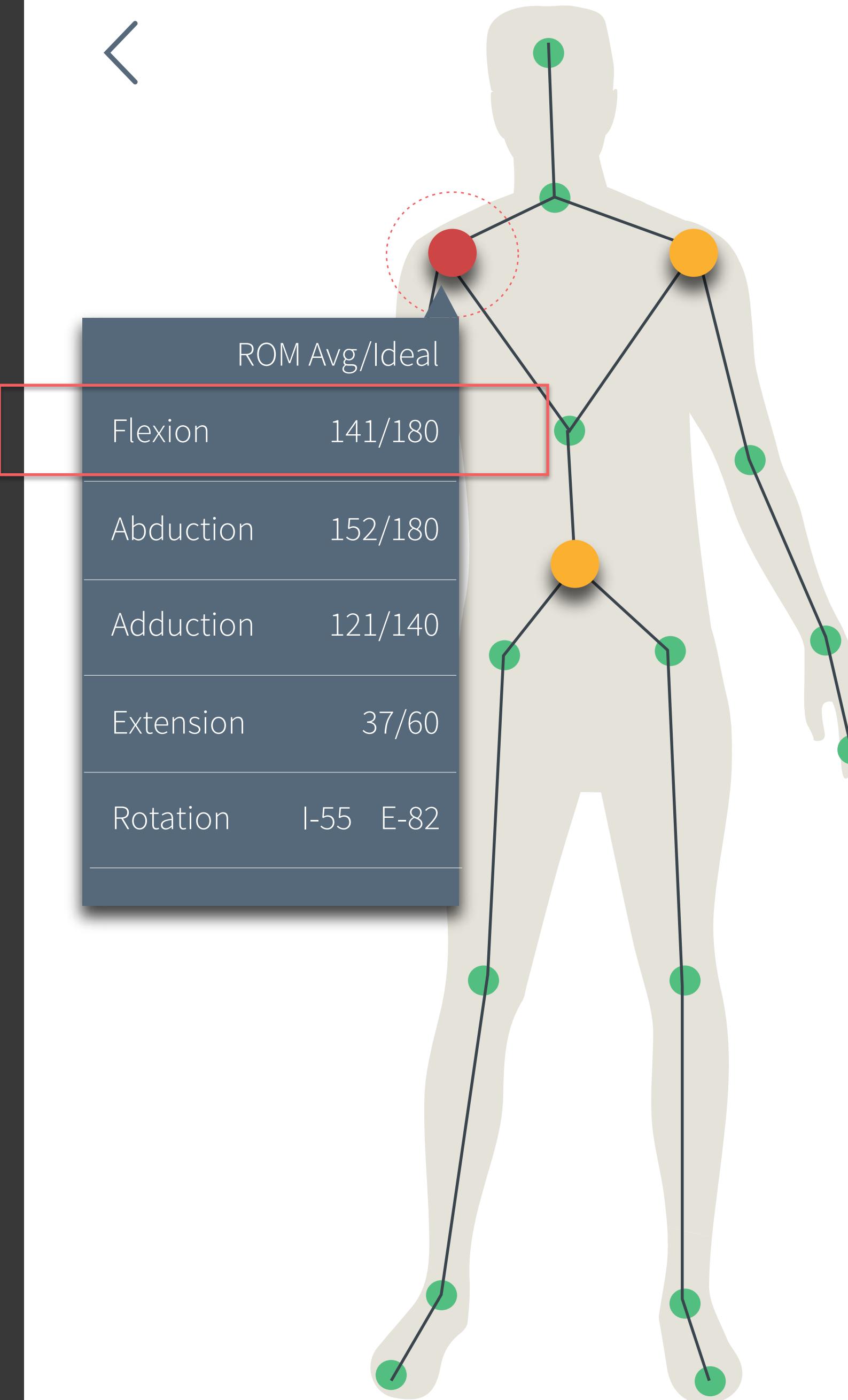


Physiotherapist



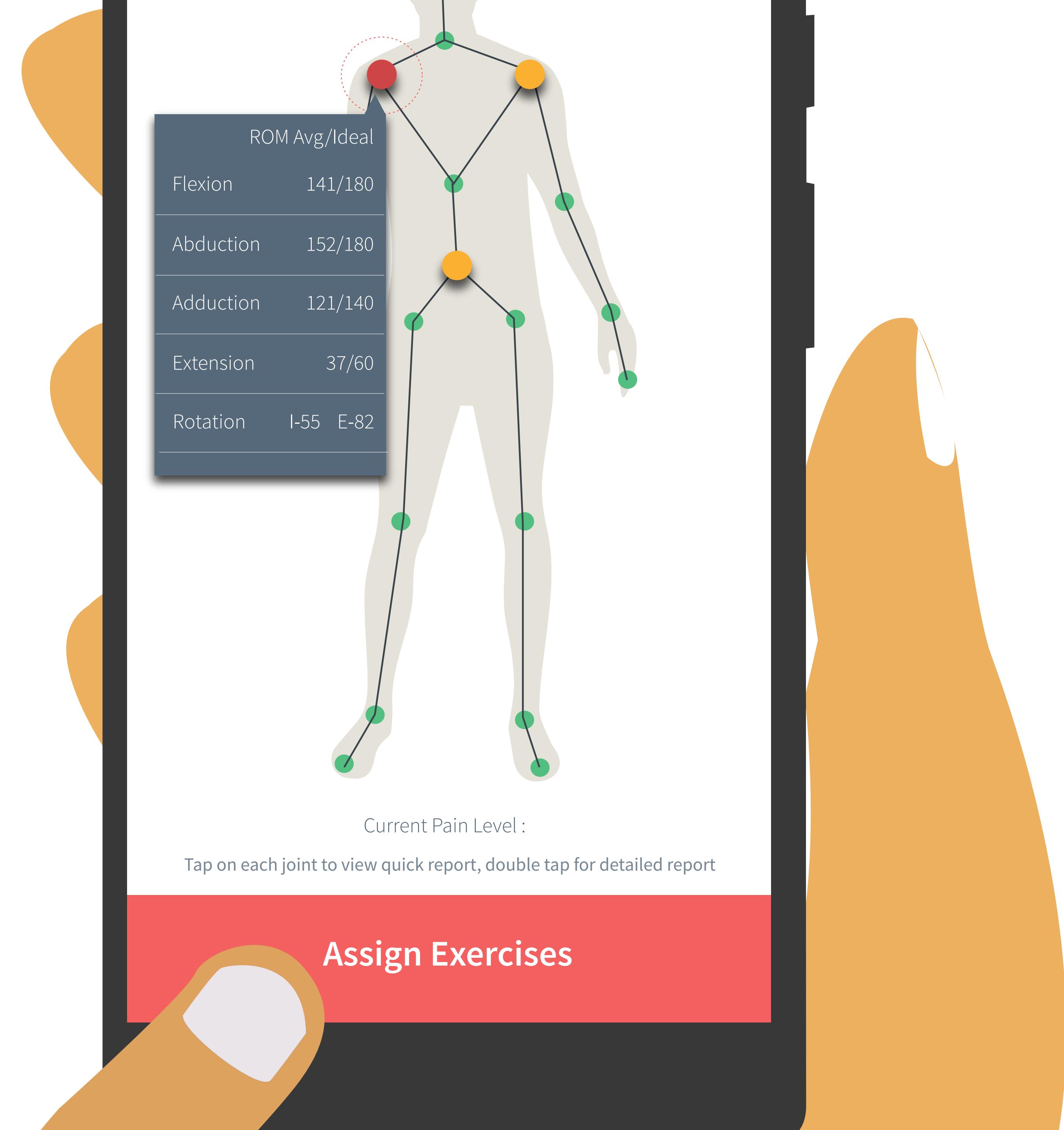
Assign Exercises

Physiotherapist

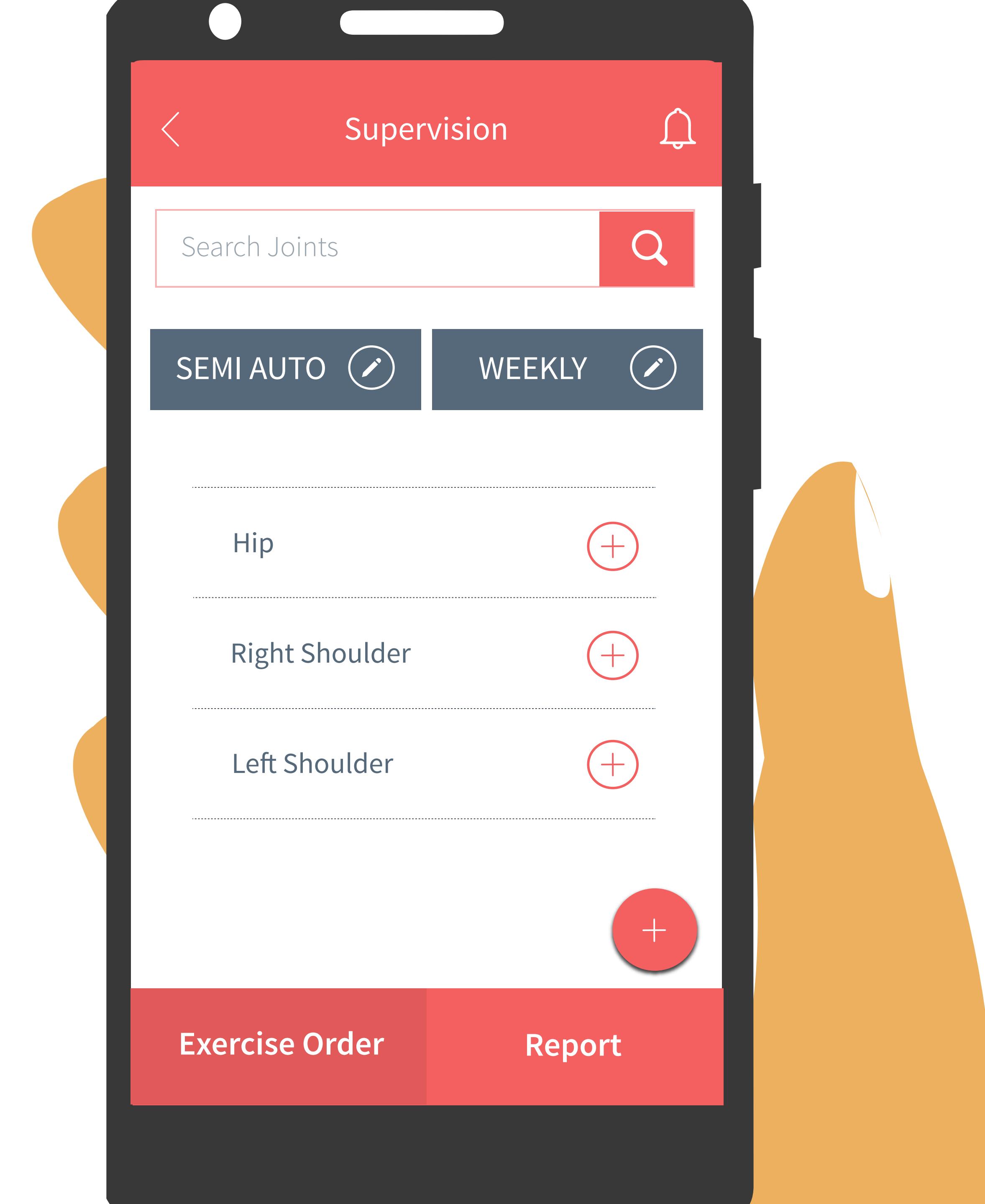


Physiotherapist

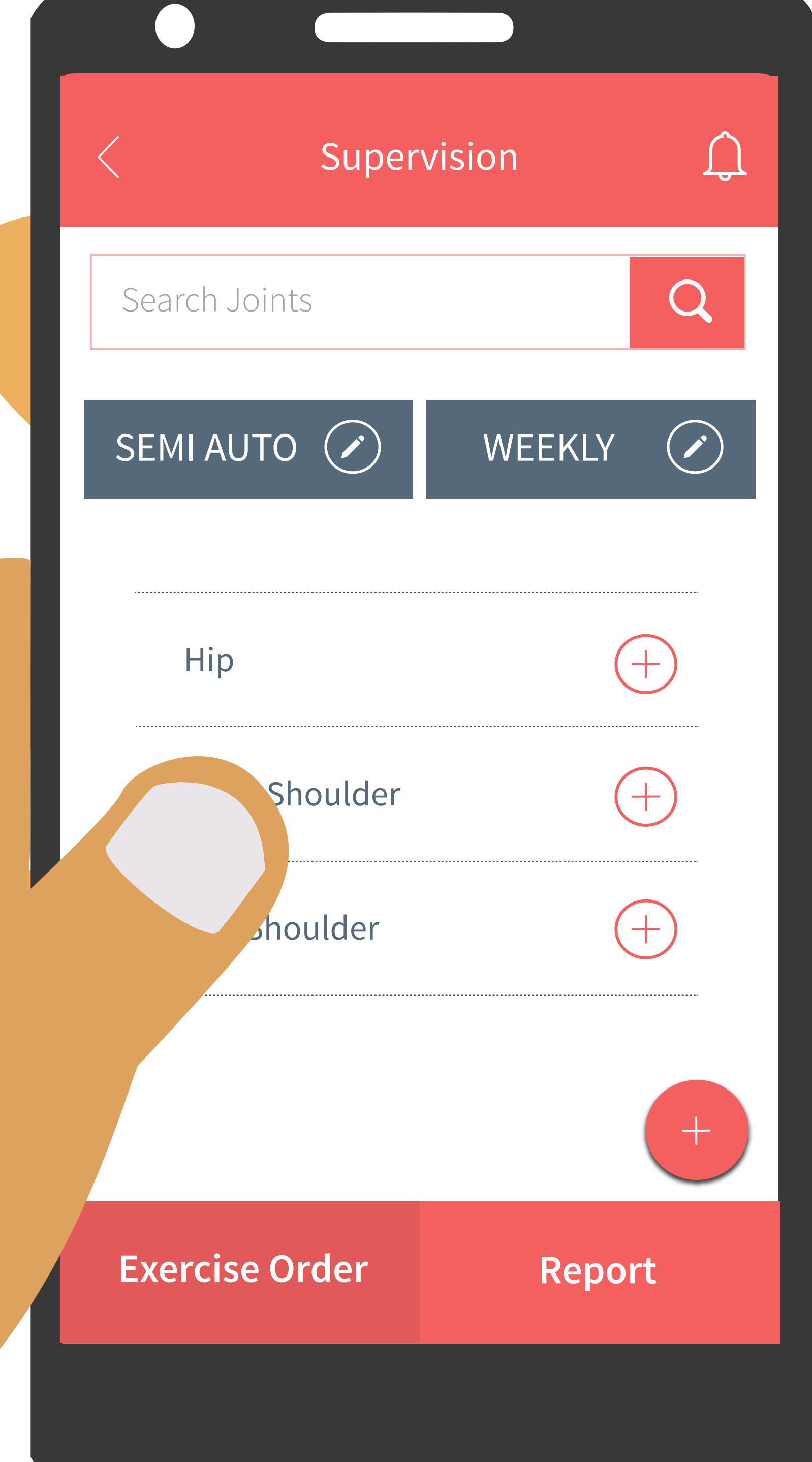
ROM Avg/Ideal	
Flexion	141/180
Abduction	152/180
Adduction	121/140
Extension	37/60
Rotation	I-55 E-82



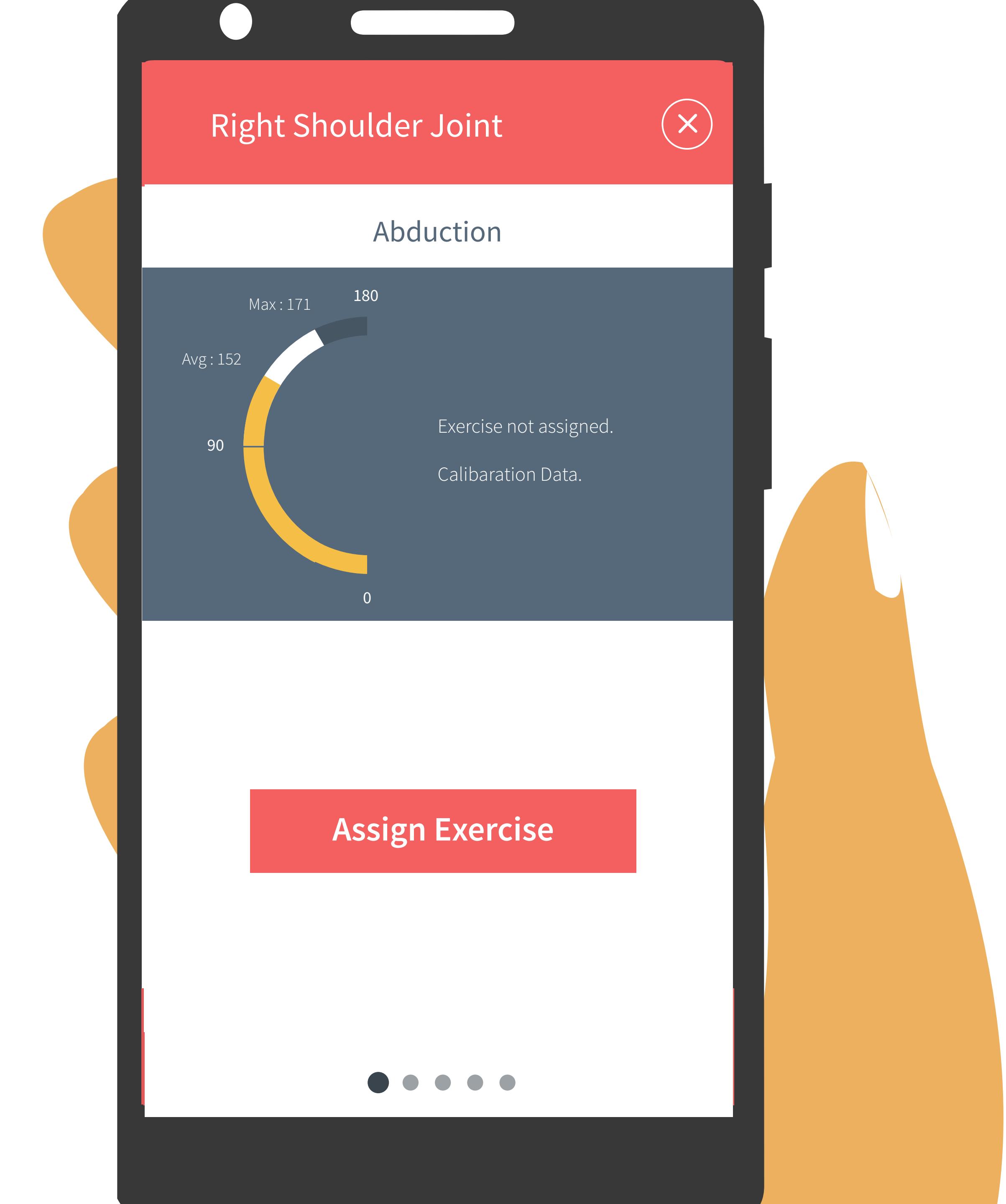
Physiotherapist



Physiotherapist

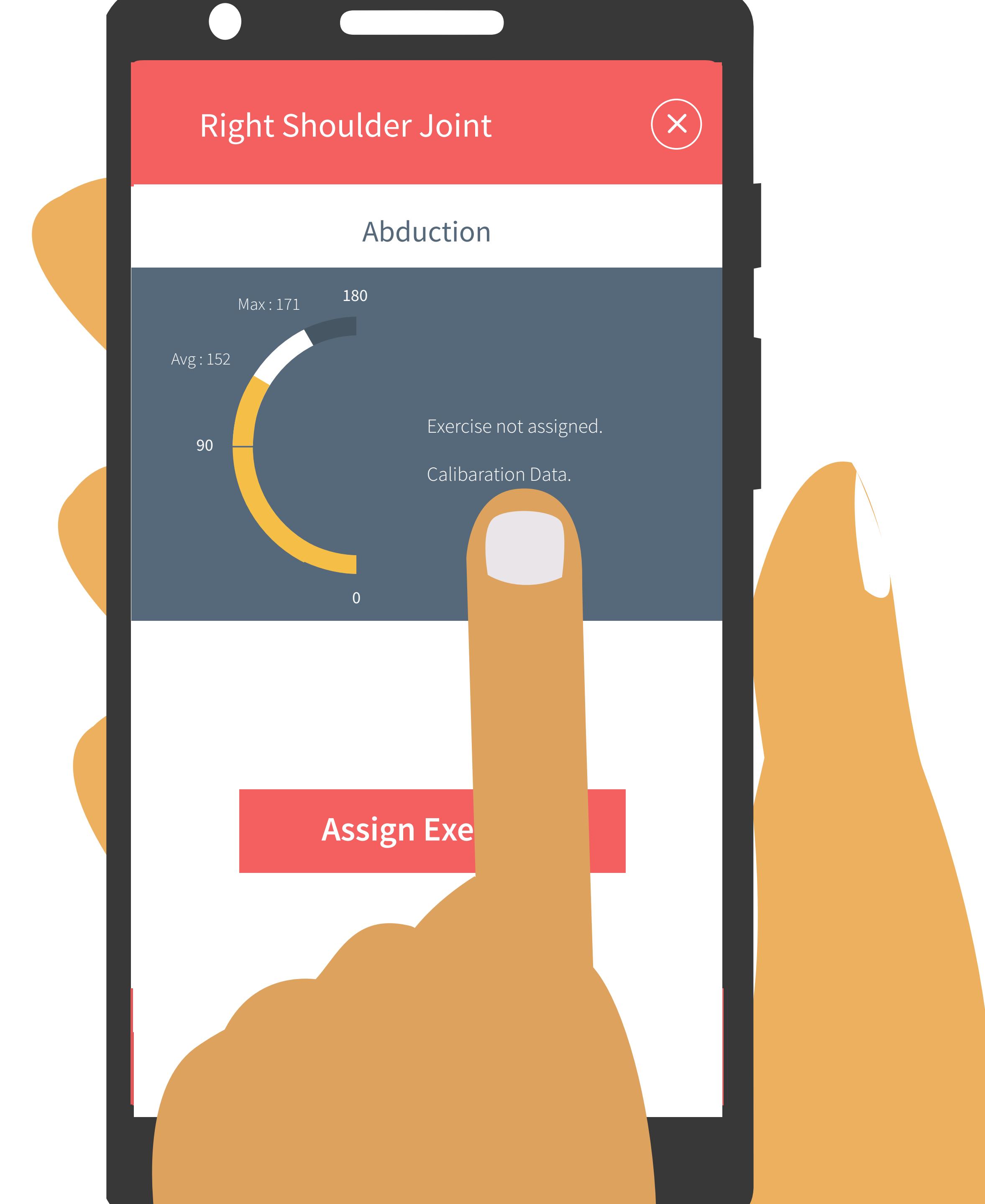


Physiotherapist

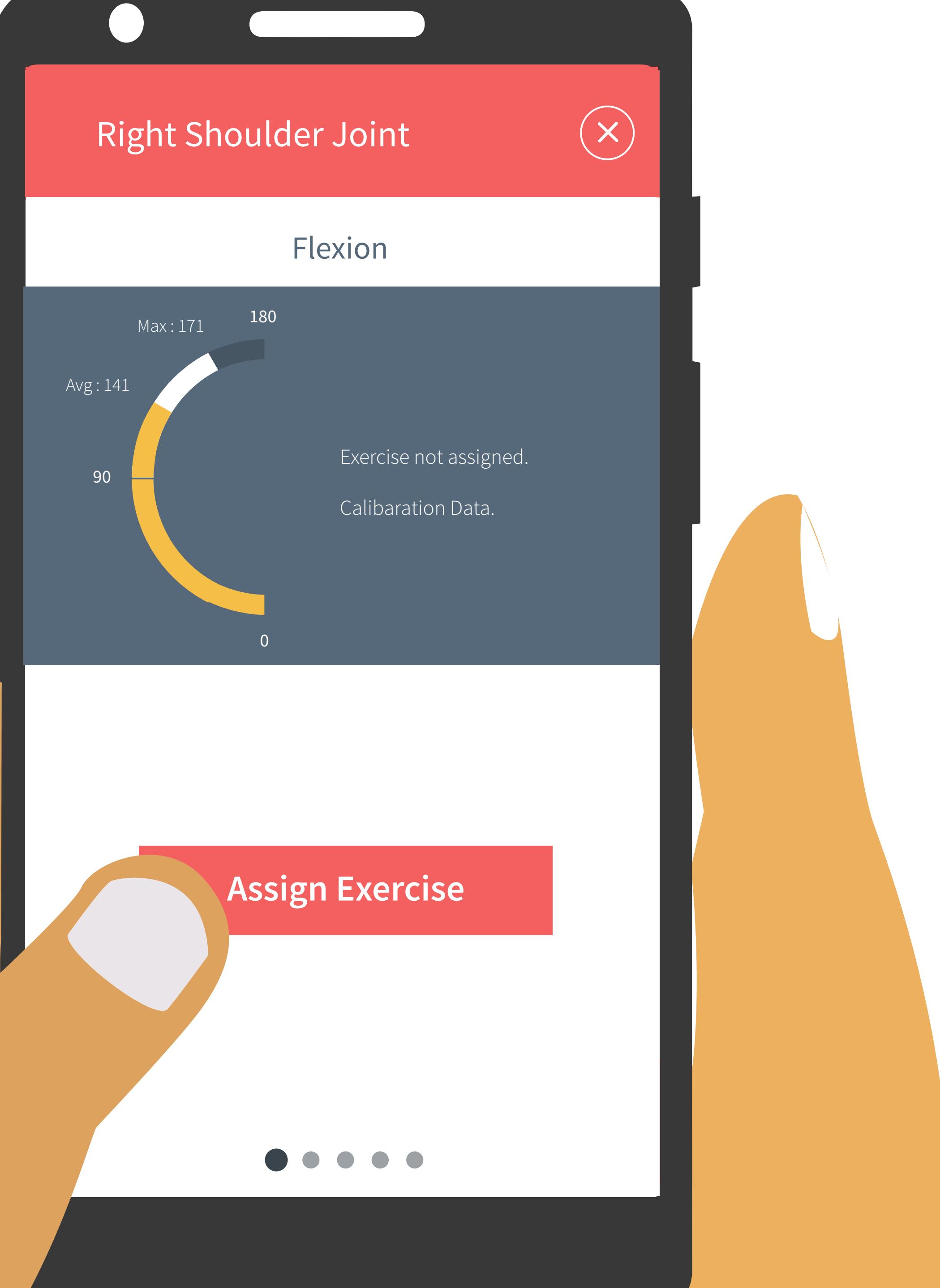


Physiotherapist

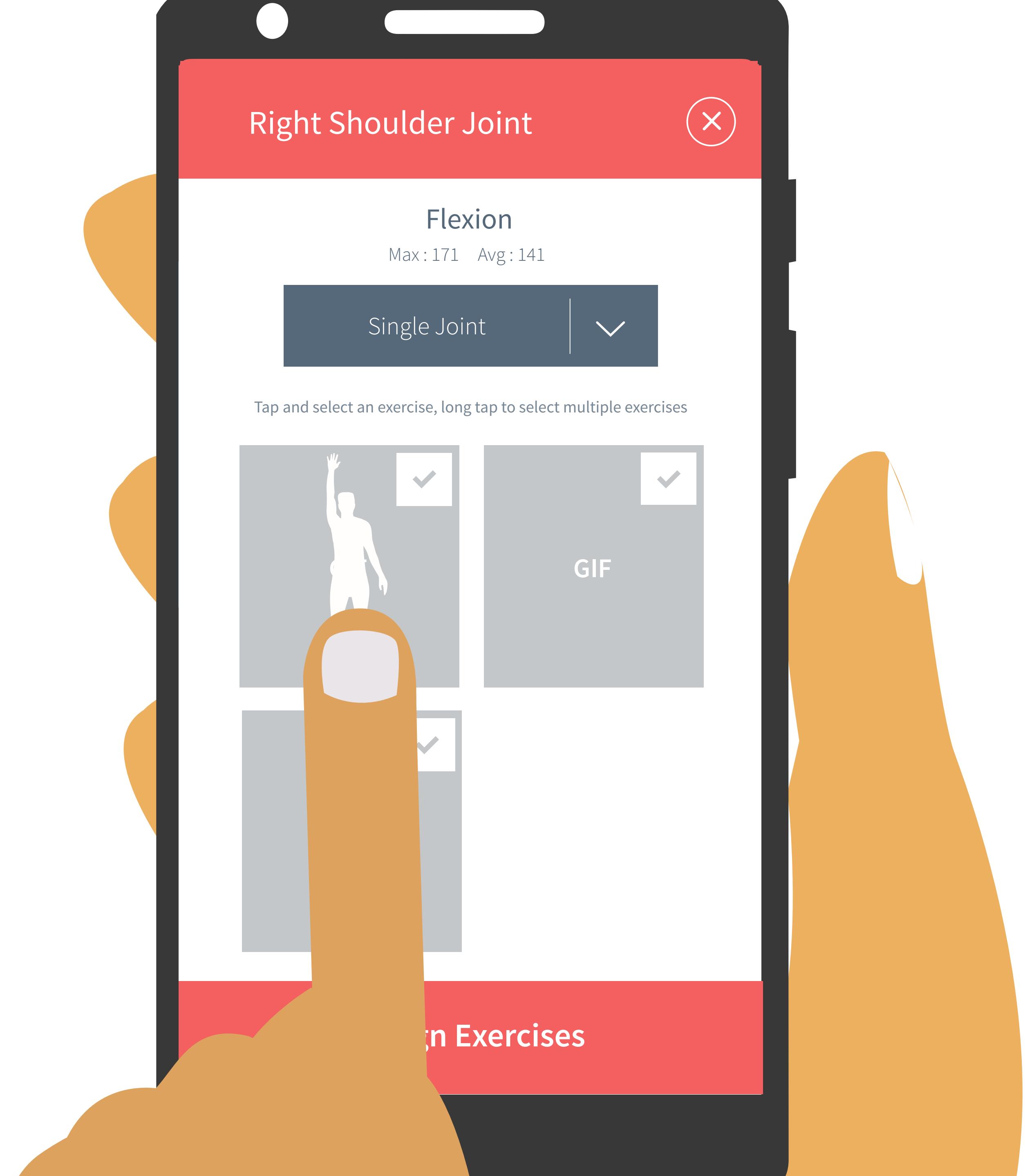
Swipe Left



Physiotherapist



Physiotherapist

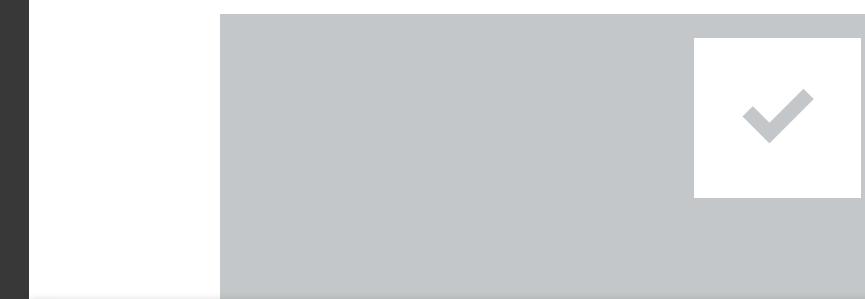
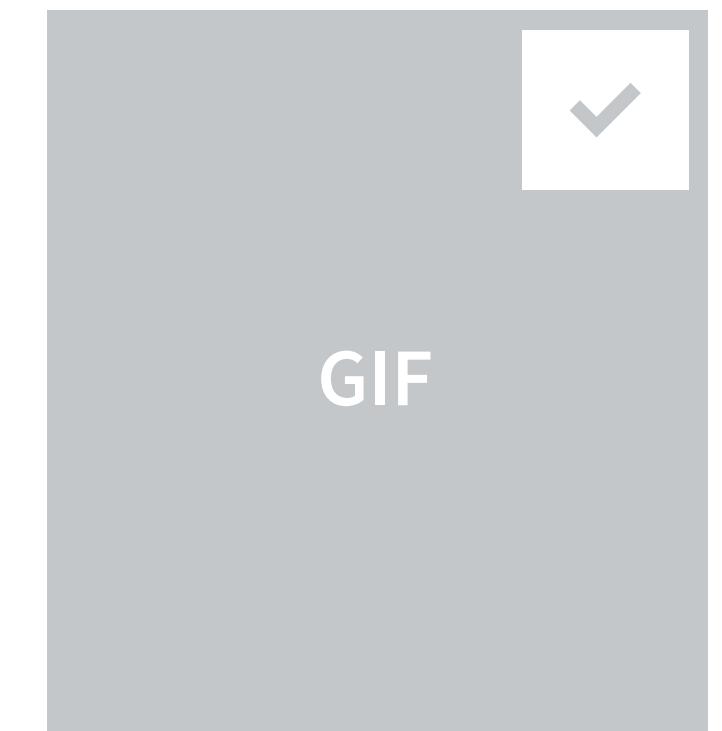
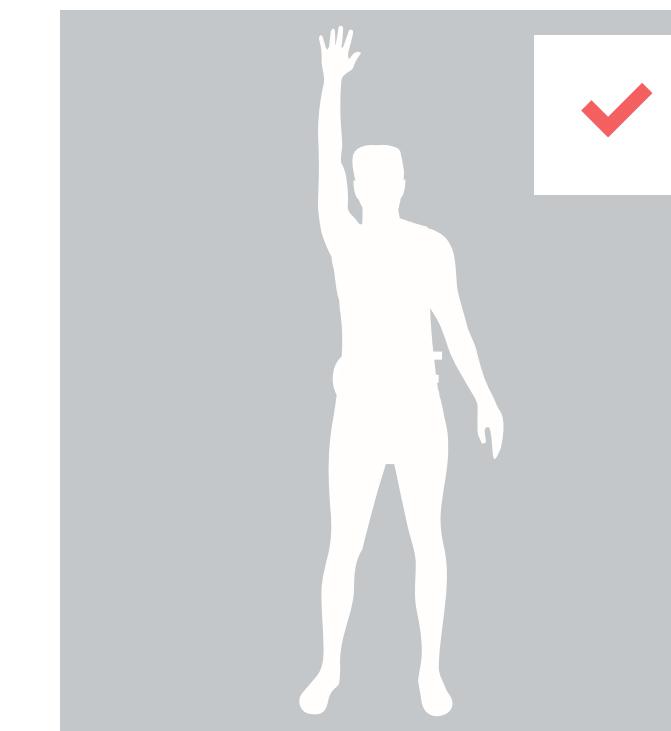


Single Joint



Physiotherapist

Tap and select an exercise, long tap to select multiple exercises



Speed

10 20 30 40 >

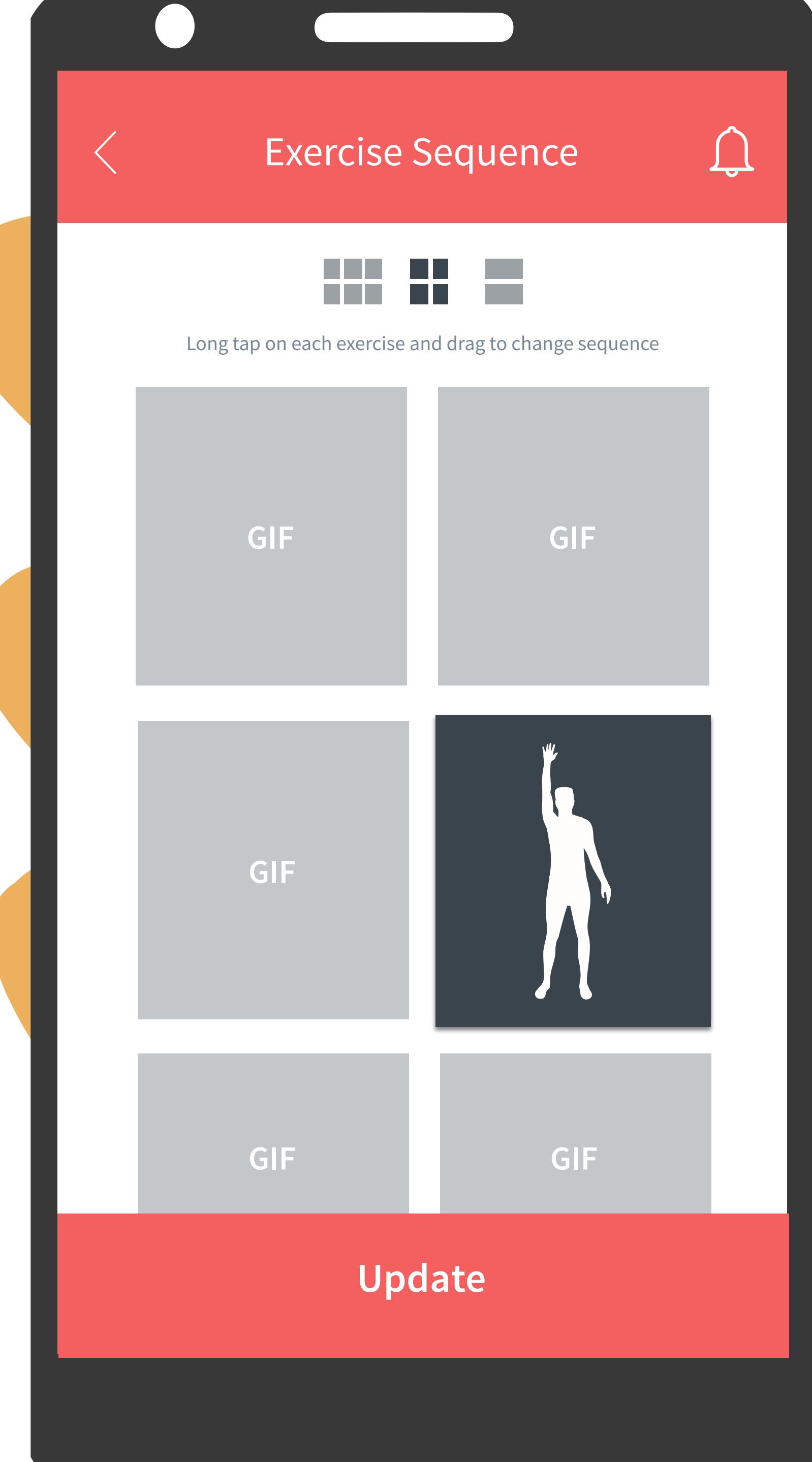
Repetitions

5 10 15 20 >

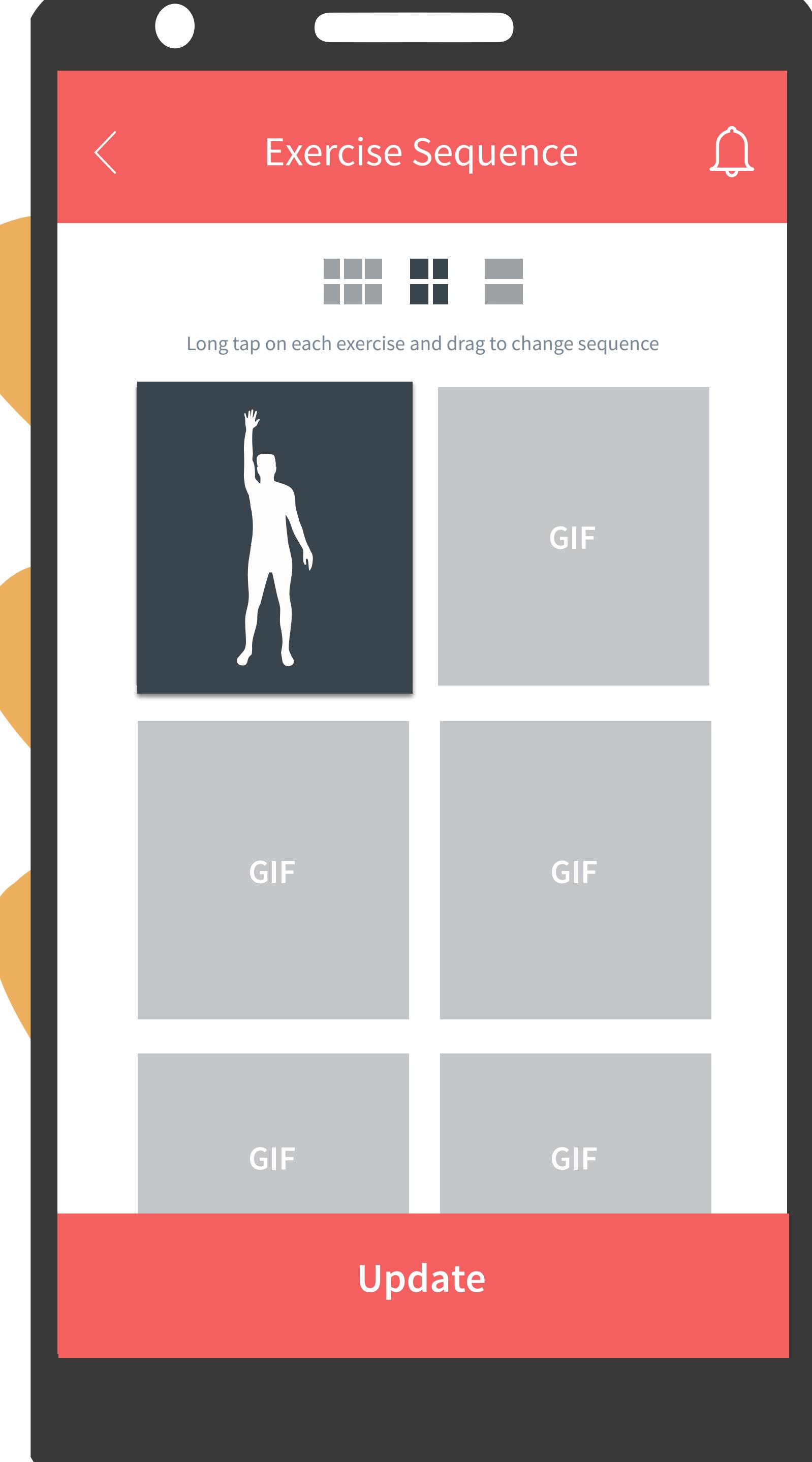
add in left shoulder

Assign Exercises

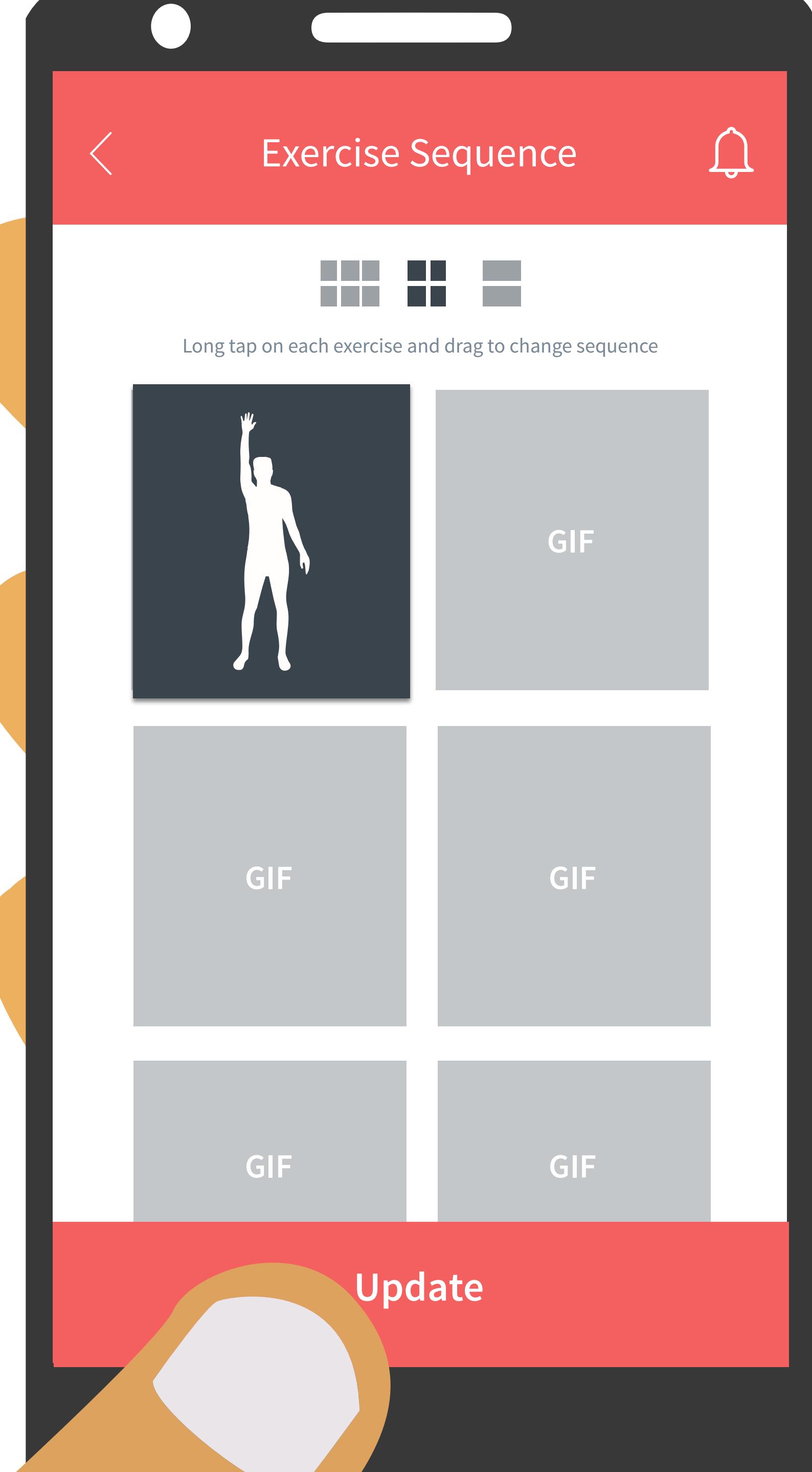
Physiotherapist



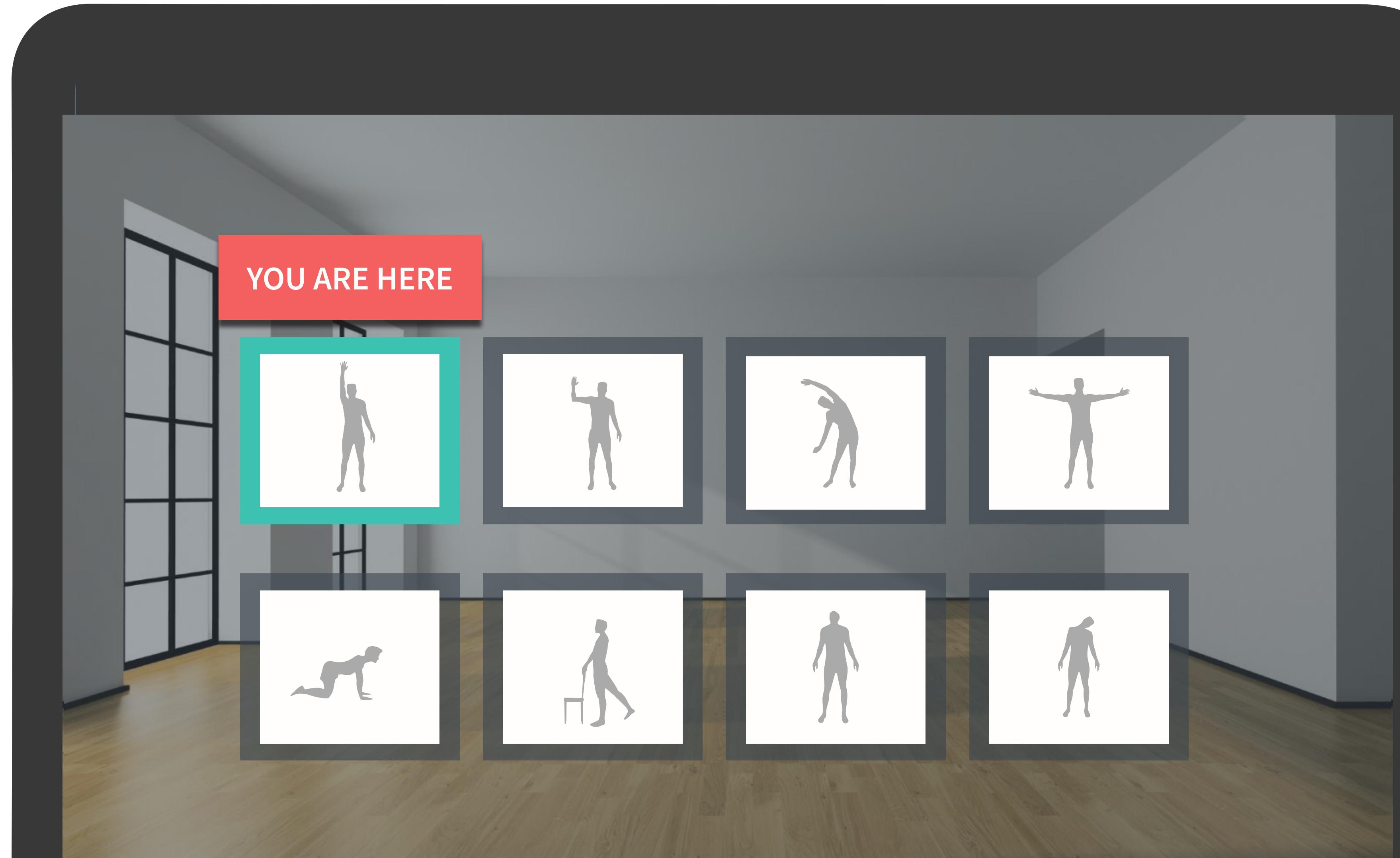
Physiotherapist



Physiotherapist



Patient



PATIENT FLOW

DAY 1

Calibration Session

Exercise & Tracking :

- Single joint exercises - 3 repetitions each.
- No redo option.

Exercise & Session Feedback :

- No exercise feedback.
- Session feedback with affected joint ROM.



An.

Exercise to Fight Ankylosing

WELCOME!

MAKE SURE YOU HAVE THESE BEFORE YOU START



YOGA MAT



CHAIR



TOWEL



SWIPE UP TO QUIT

TO PROCEED RAISE RIGHT HAND



CHOOSE YOUR INSTRUCTOR

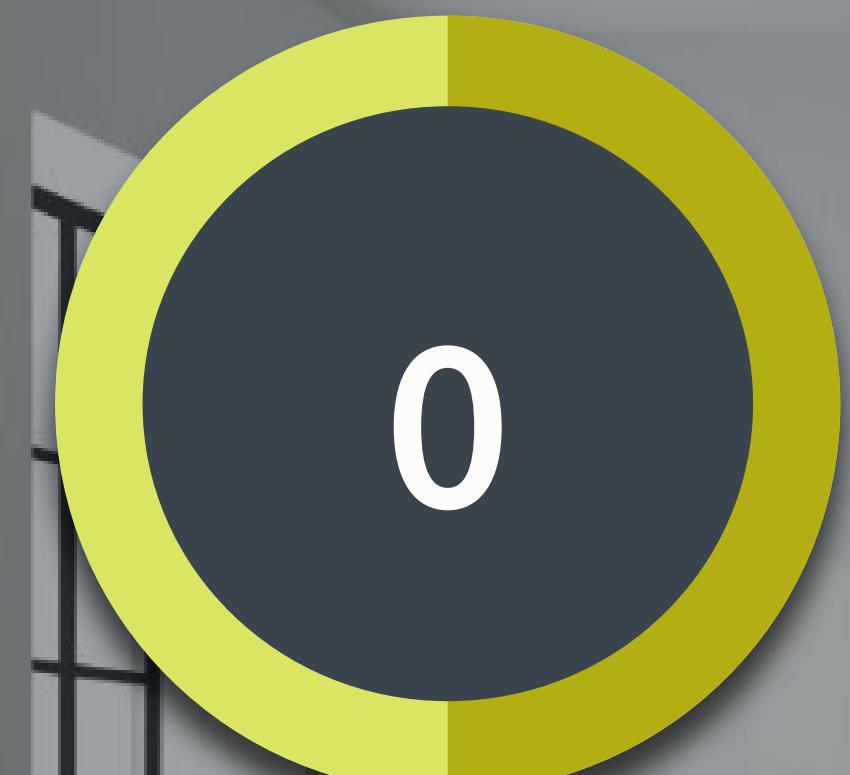


RAISE LEFT HAND

SWIPE UP TO QUIT

RAISE RIGHT HAND

SELECT YOUR CURRENT PAIN LEVEL



BACK

SWIPE UP TO QUIT



NEXT

RAISE RIGHT HAND

WHEN READY





0:01



0

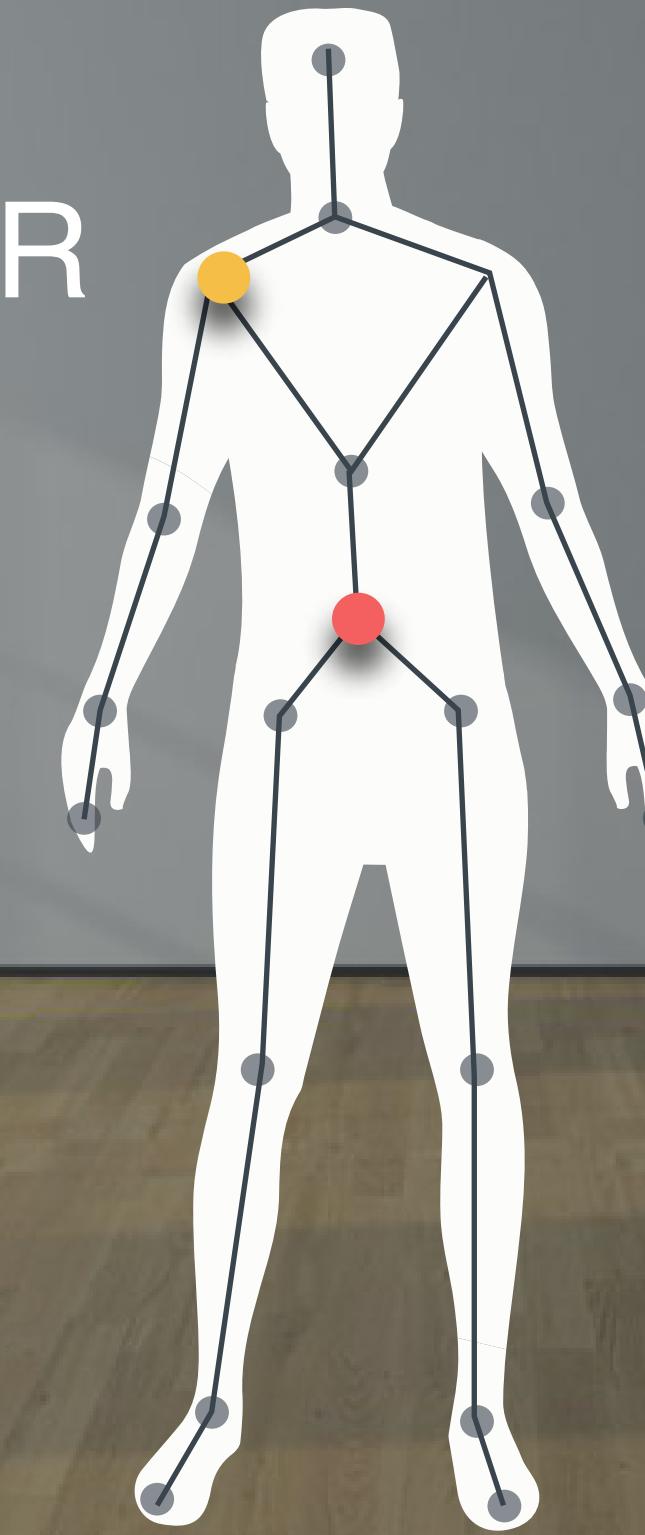


SESSION PERFORMANCE

AFFECTED JOINTS

RIGHT SHOULDER

HIP



MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE

Let us start working on your
left and right shoulders from tomorrow!



MENU

SWIPE UP TO QUIT



GAMES

DAY 2

WELCOME!

MAKE SURE YOU HAVE THESE BEFORE YOU START



YOGA MAT



CHAIR



TOWEL



LOADING...

SELECT YOUR CURRENT PAIN LEVEL



BACK

SWIPE UP TO QUIT



NEXT

DIET TIP

**Tomato has liyocpene
which fights inflammation.**



LOADING...

SWIPE UP TO QUIT



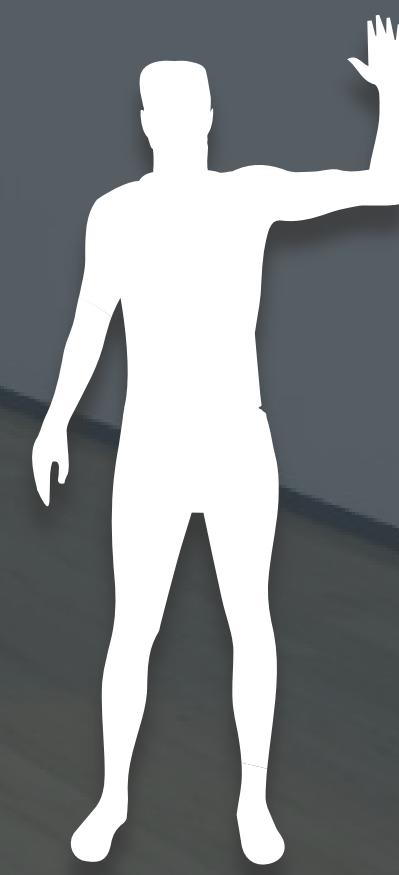
TO EXERCISE

RAISE LEFT HAND



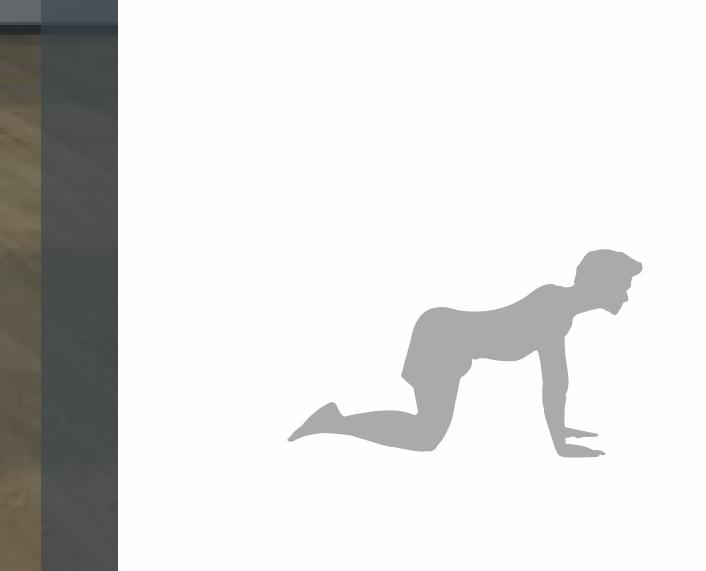
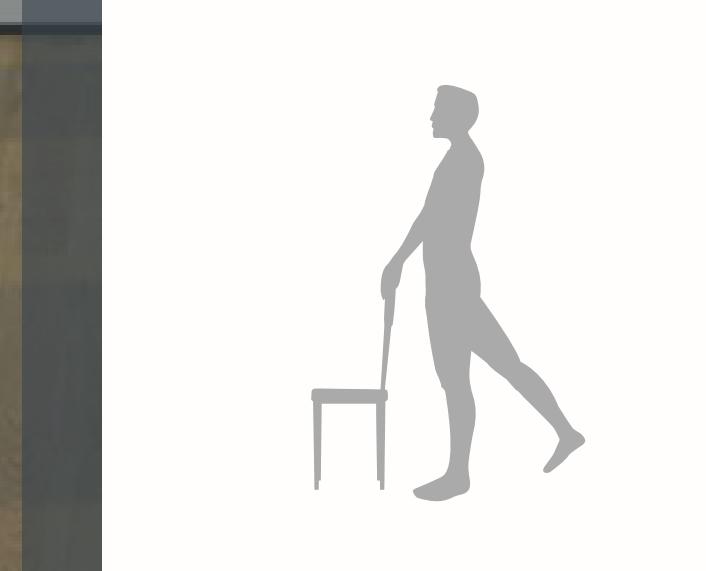
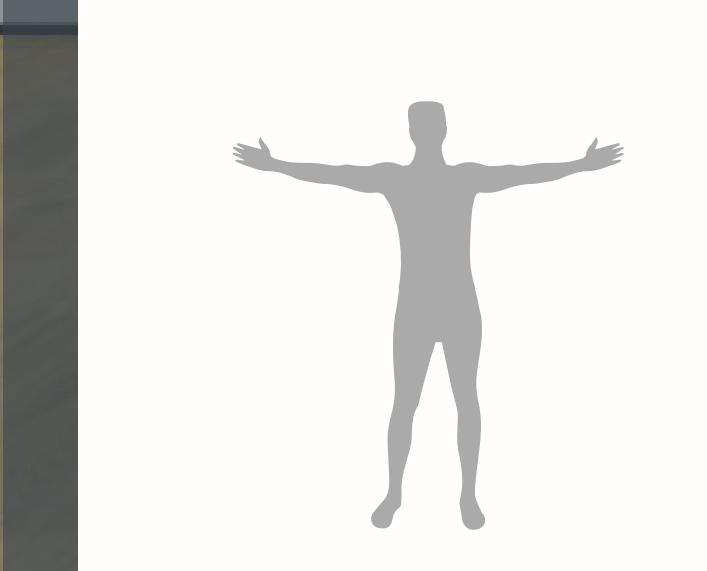
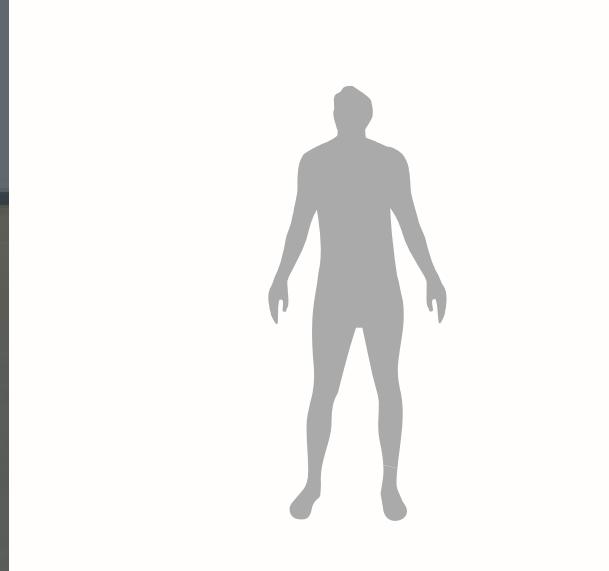
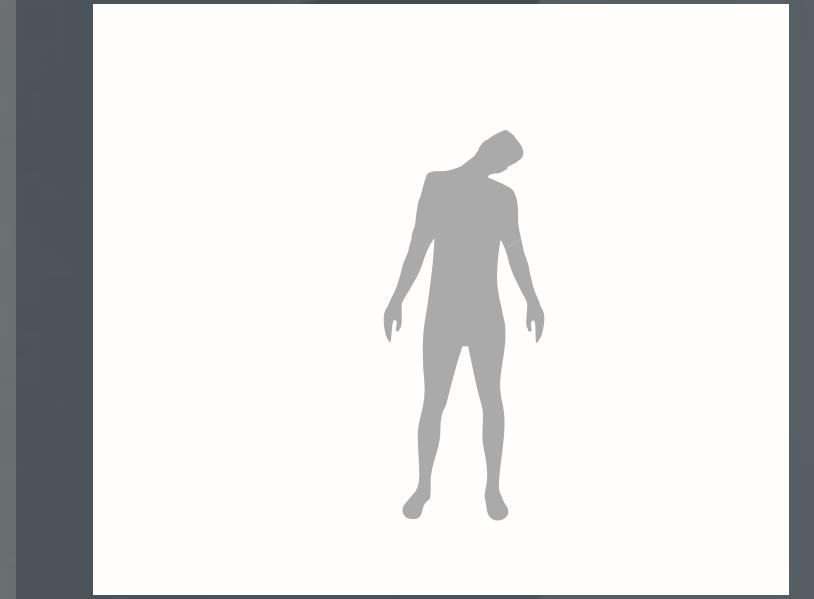
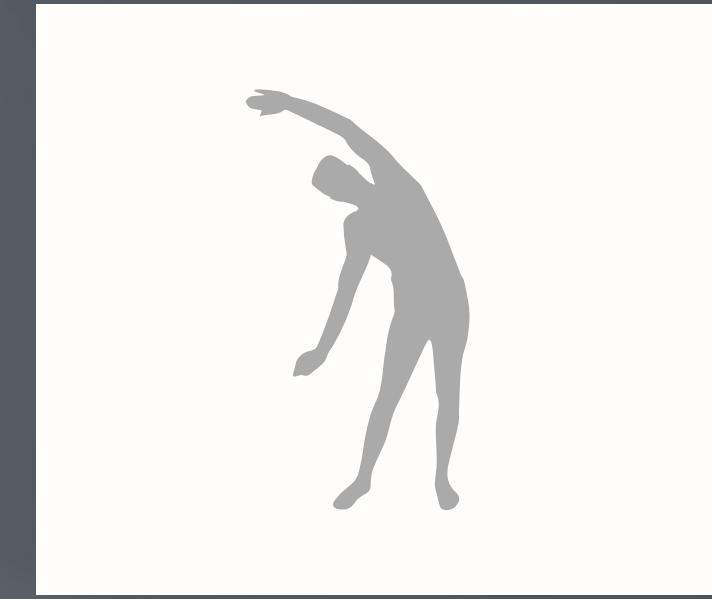
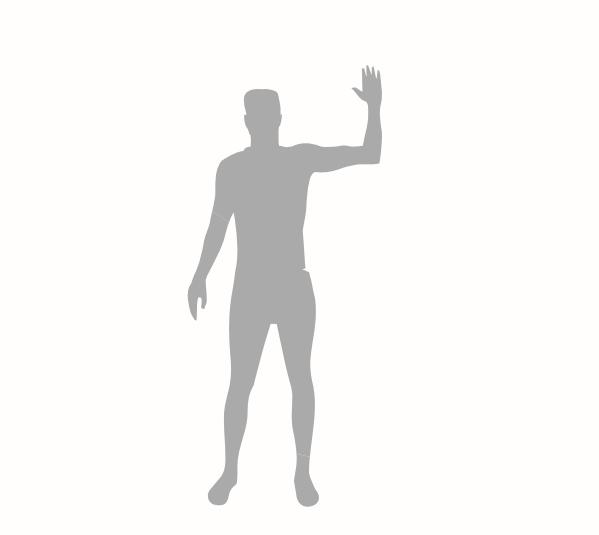
TO PLAY GAMES

RAISE RIGHT HAND



FOR HISTORY SWIPE DOWN

YOU ARE HERE



RAISE RIGHT HAND

WHEN READY





0:31



4



EXERCISE PERFORMANCE

EXERCISE TIME

0:39

REPETITIONS

5



REPEAT

SWIPE UP FOR MENU

NEXT



EXERCISE PERFORMANCE

EXERCISE TIME

0:39

REPETITIONS

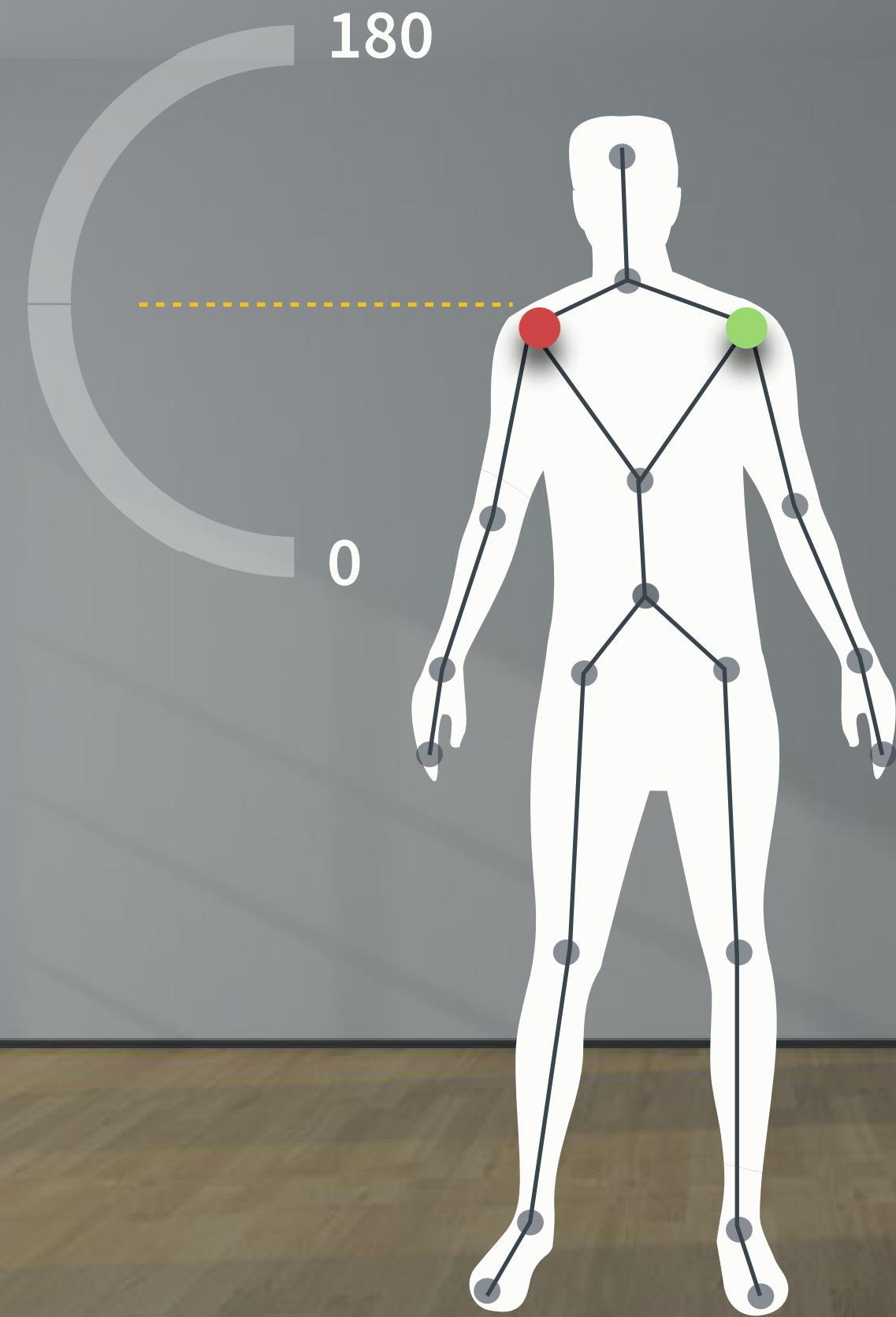
5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME

 0:39

REPETITIONS

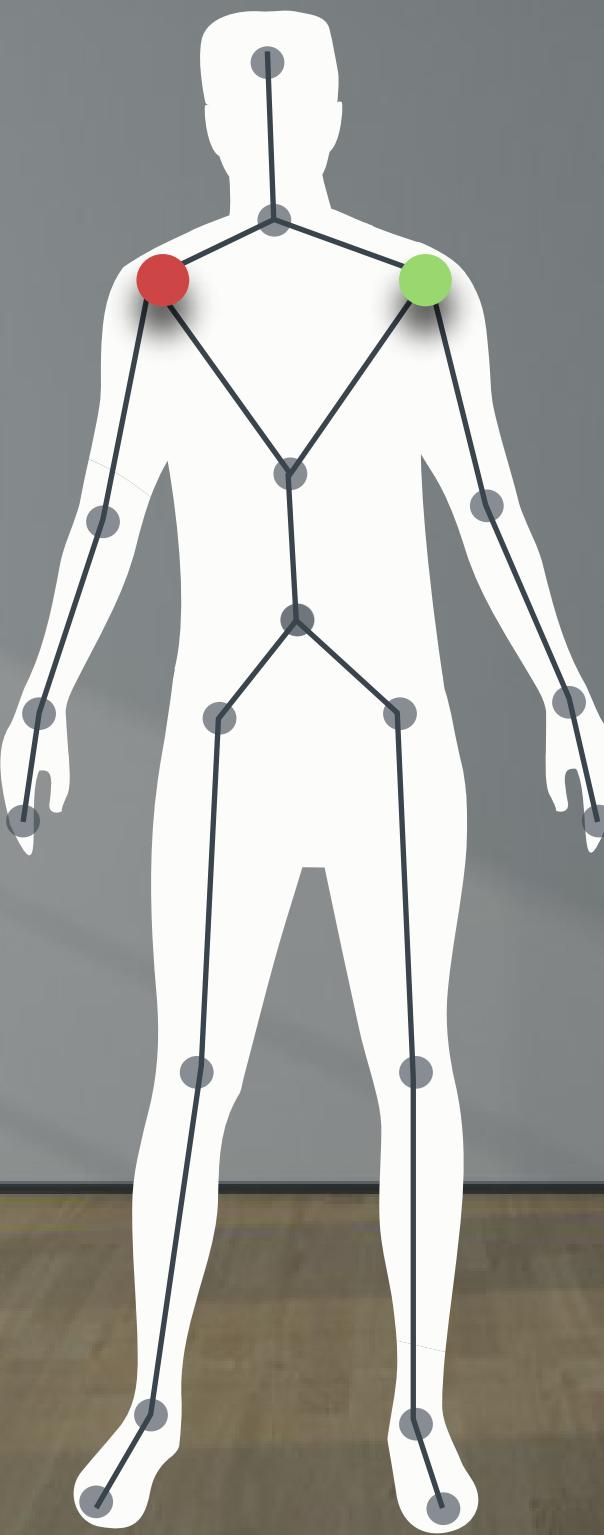
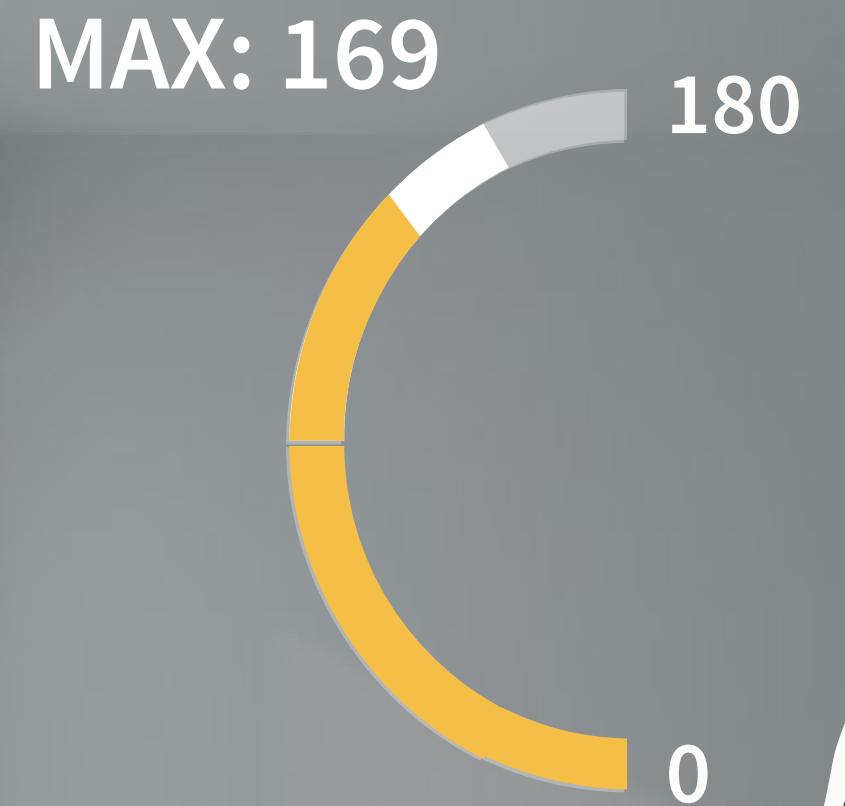
5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME

0:39

REPETITIONS

5

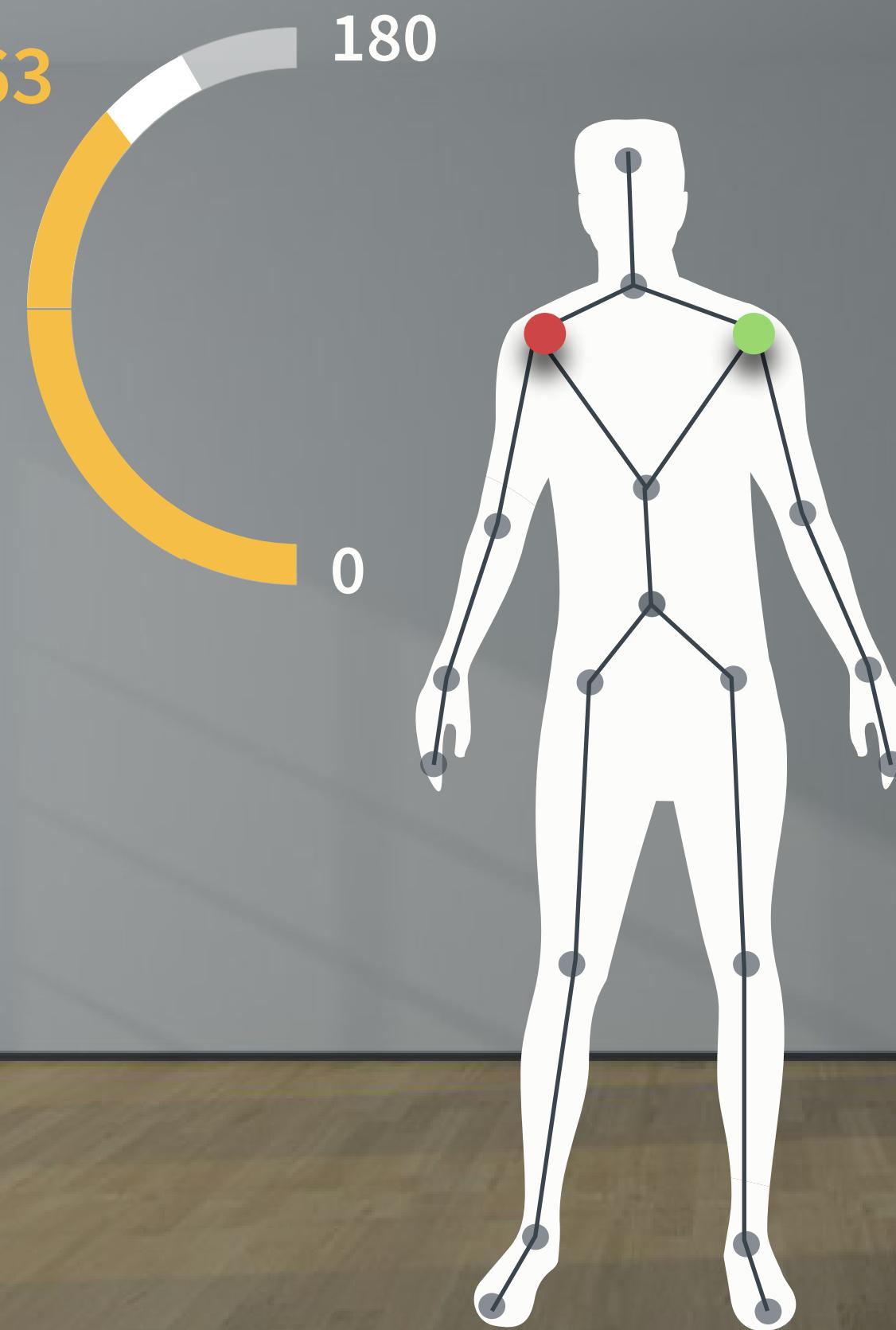
REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE

AVG: 163



EXERCISE TIME

0:39

REPETITIONS

5

REPEAT

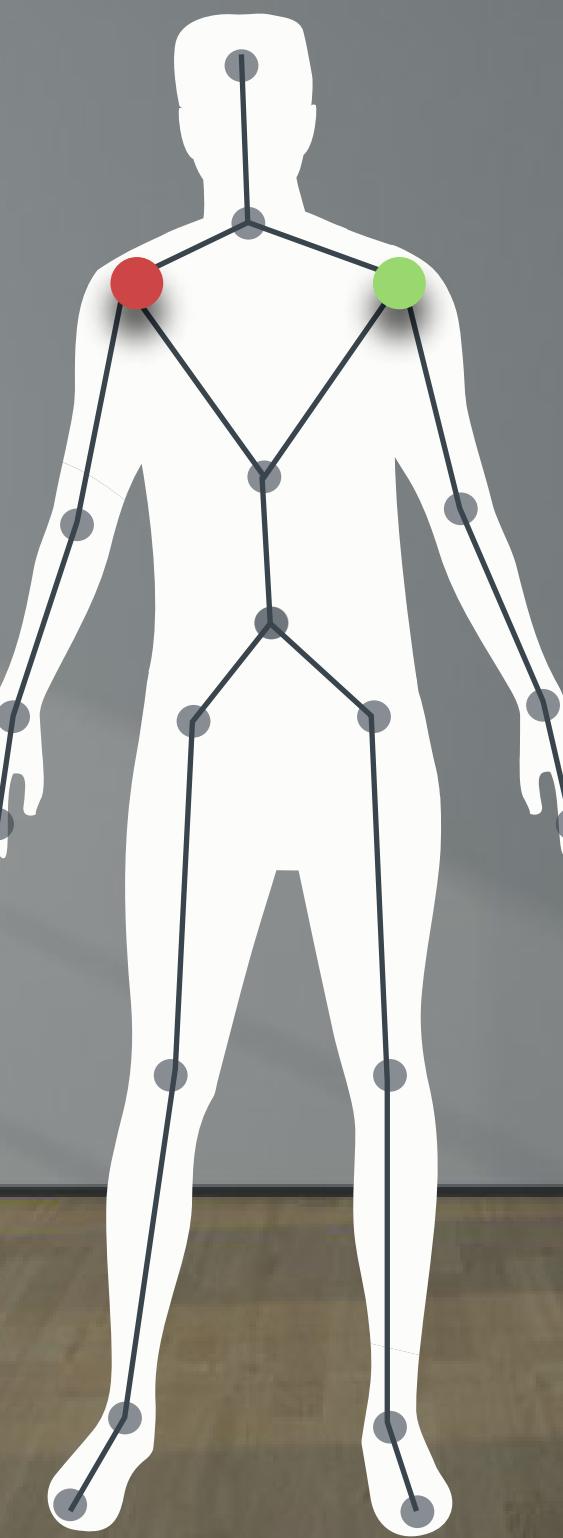
SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE

180
0
Today
Avg : 163

Yesterday
Avg : 169



EXERCISE TIME

 0:39

REPETITIONS

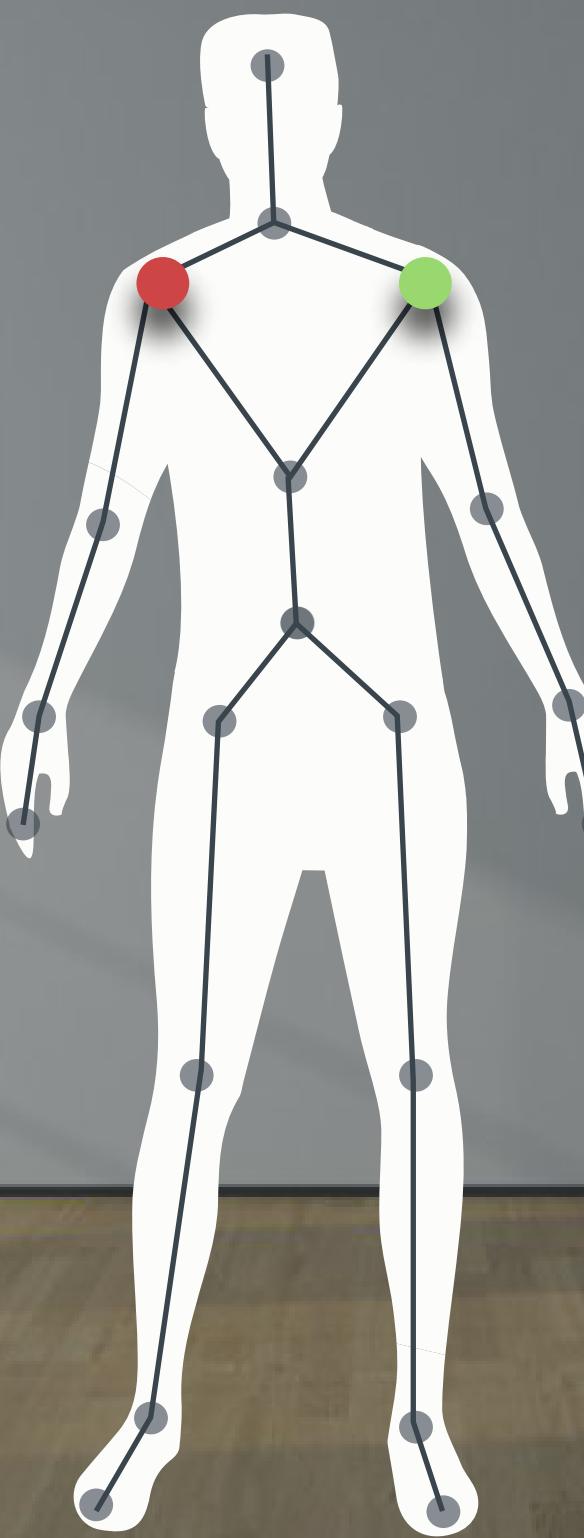
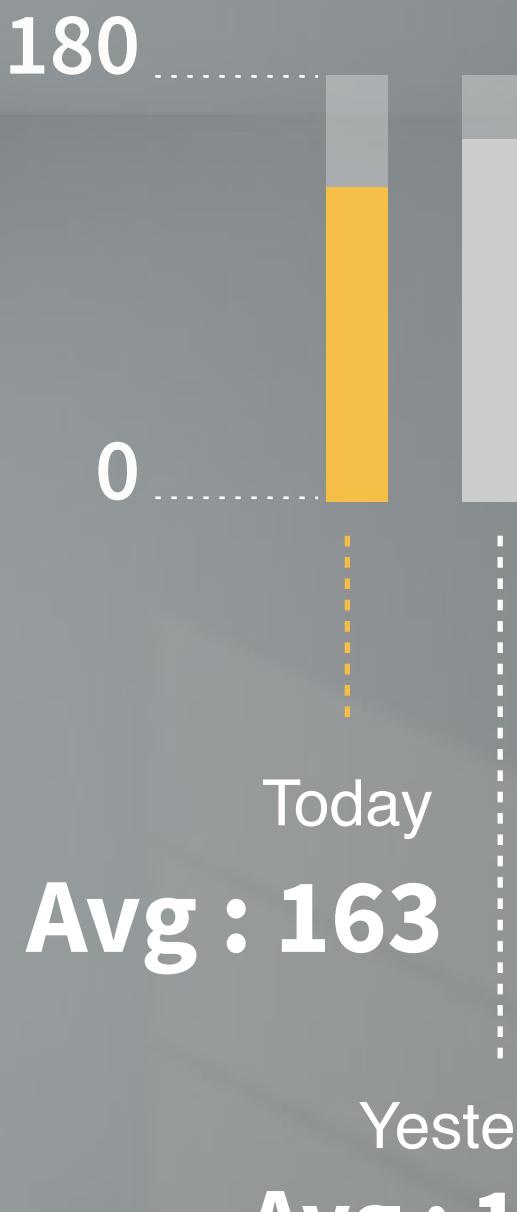
5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME

0:39

REPETITIONS

5

REPEAT

SWIPE UP FOR MENU

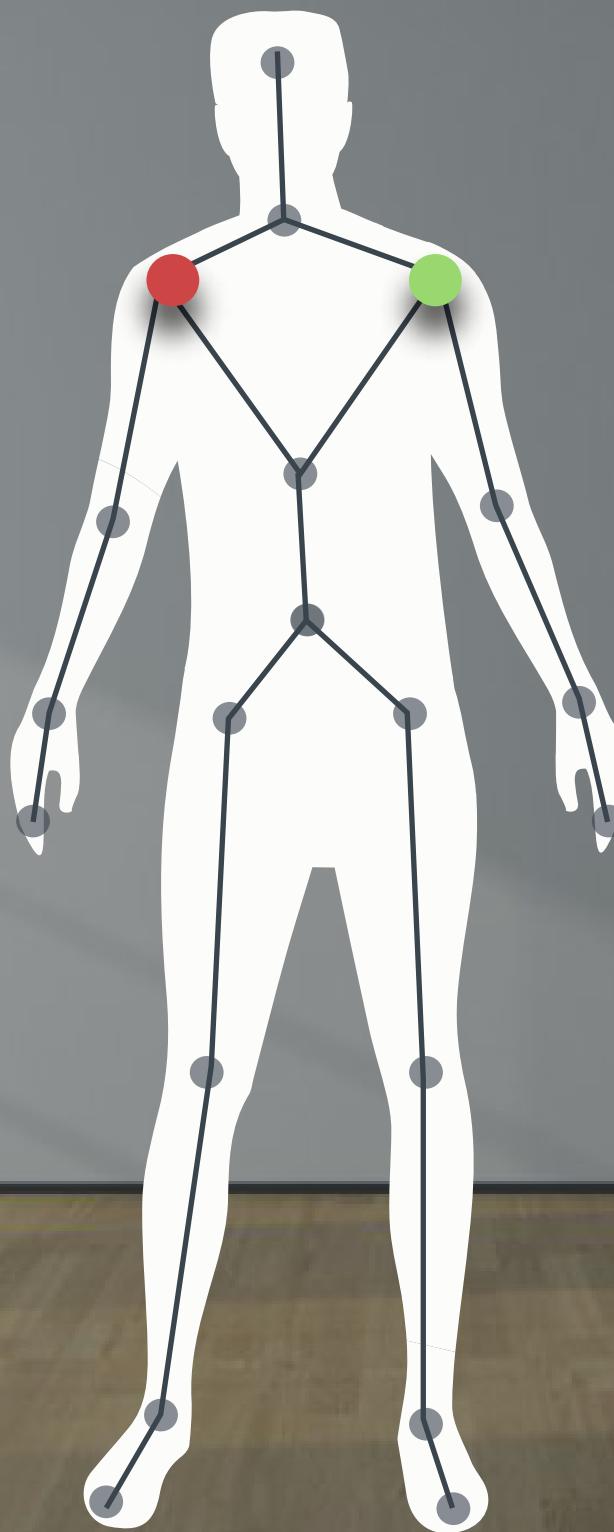
NEXT

EXERCISE PERFORMANCE

4%

Deterioration

Don't worry! Try to improve
in the next session



EXERCISE TIME

0:39

REPETITIONS

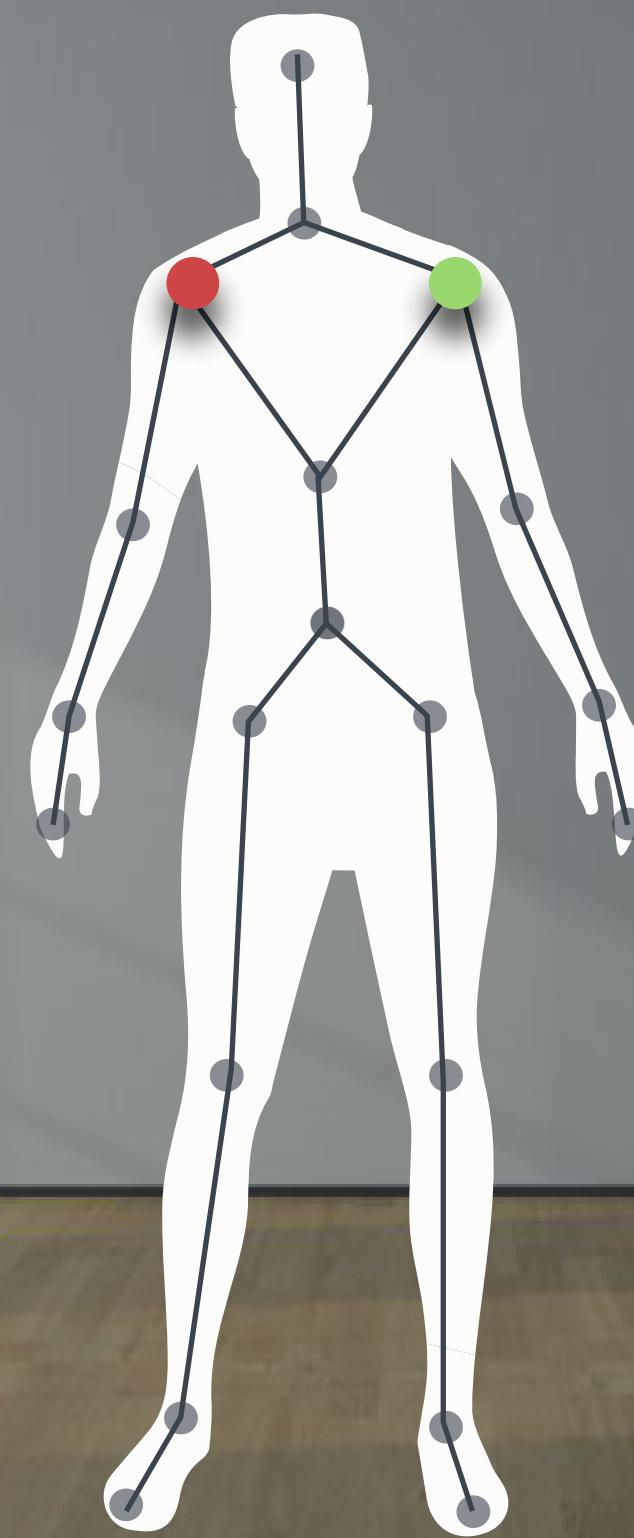
5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME

0:39

REPETITIONS

5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE

OVERALL PROGRESS

3%



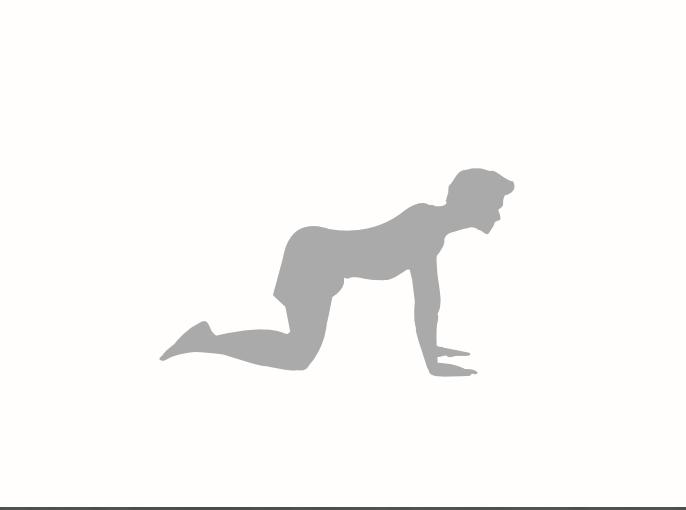
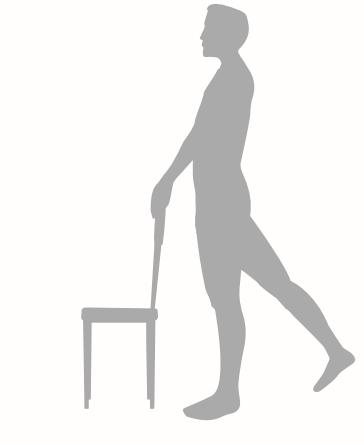
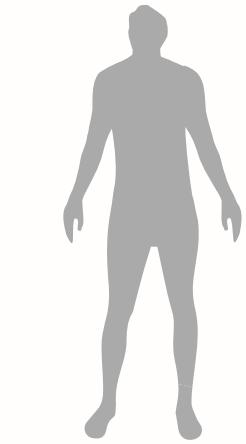
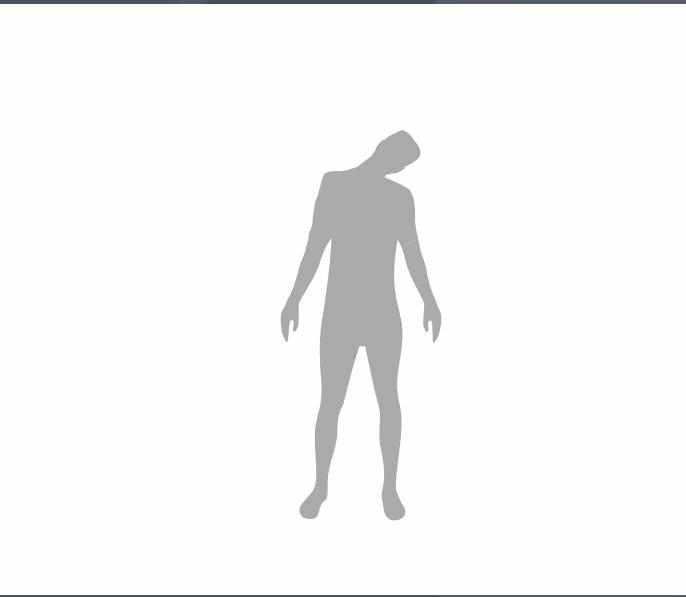
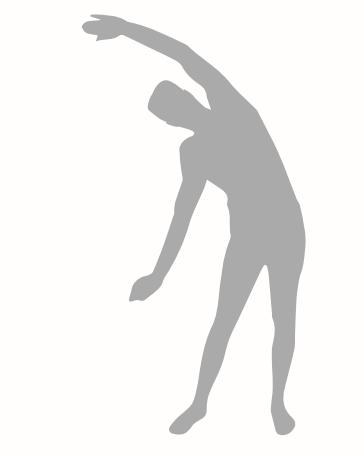
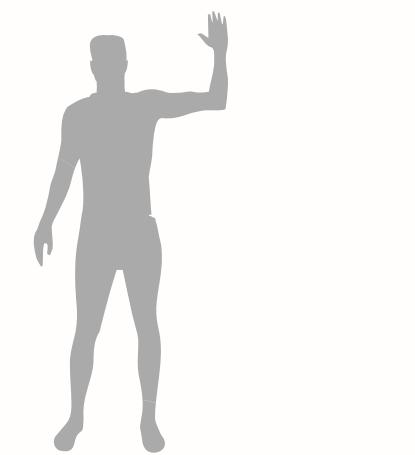
REPEAT

SWIPE UP FOR MENU

NEXT



YOU ARE HERE



RAISE RIGHT HAND

WHEN READY





0:31

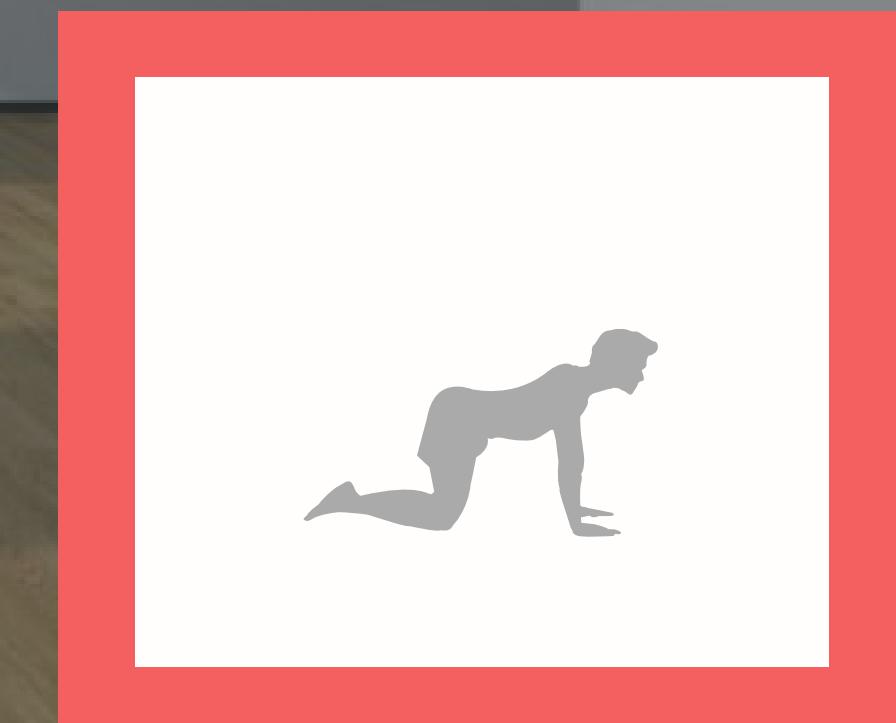
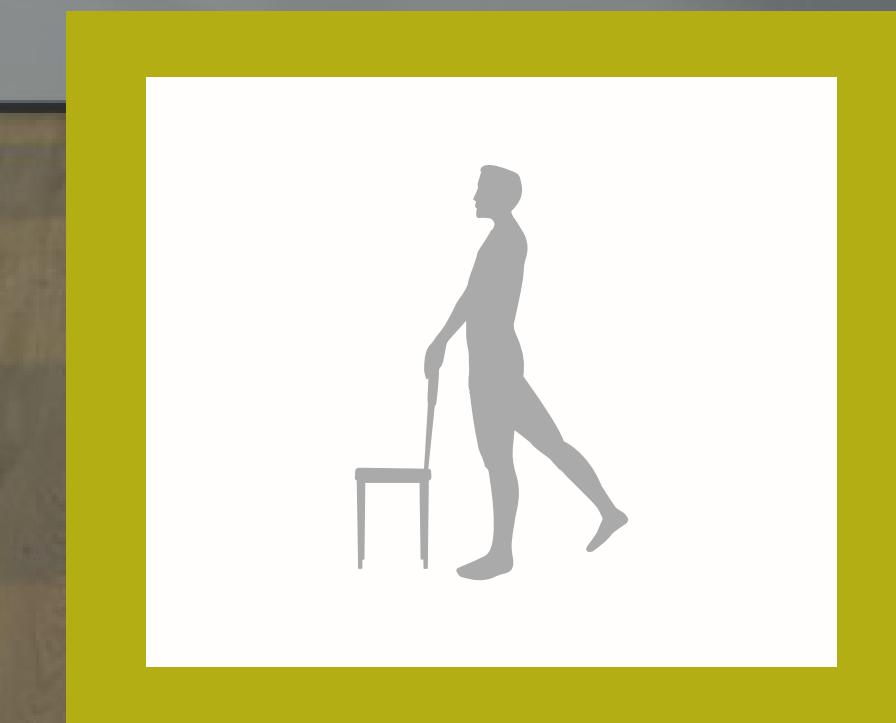
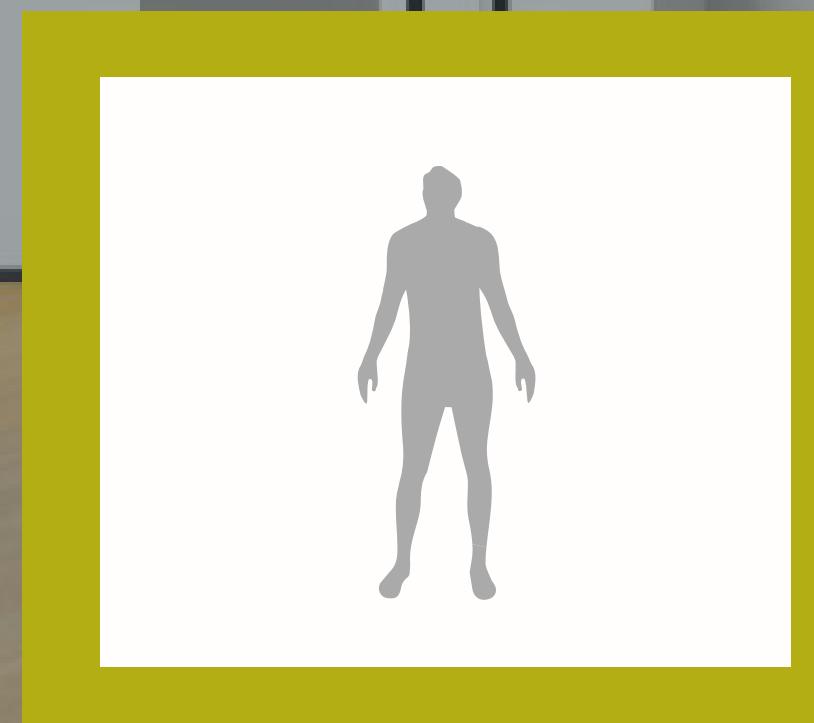
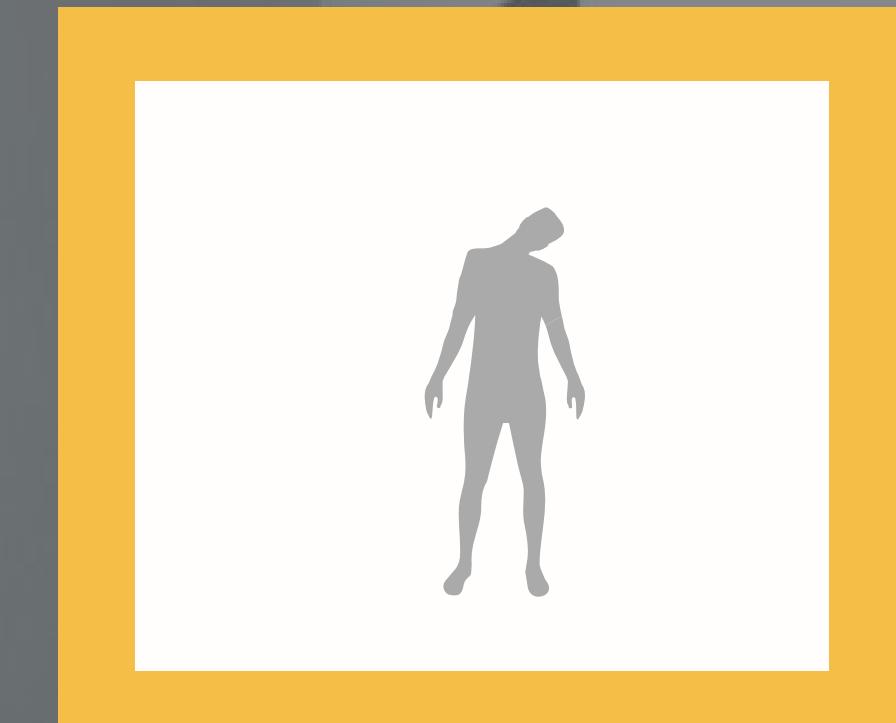
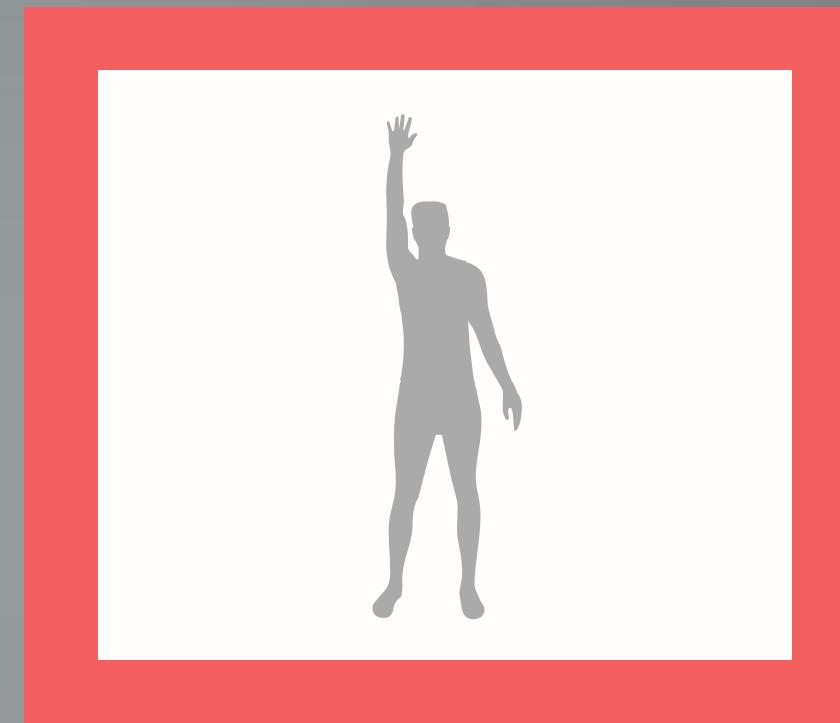


4



SESSION FEEDBACK

OVERALL PERFORMANCE



SESSION PERFORMANCE

SESSION TIME

10:49

MENU

SWIPE UP TO QUIT

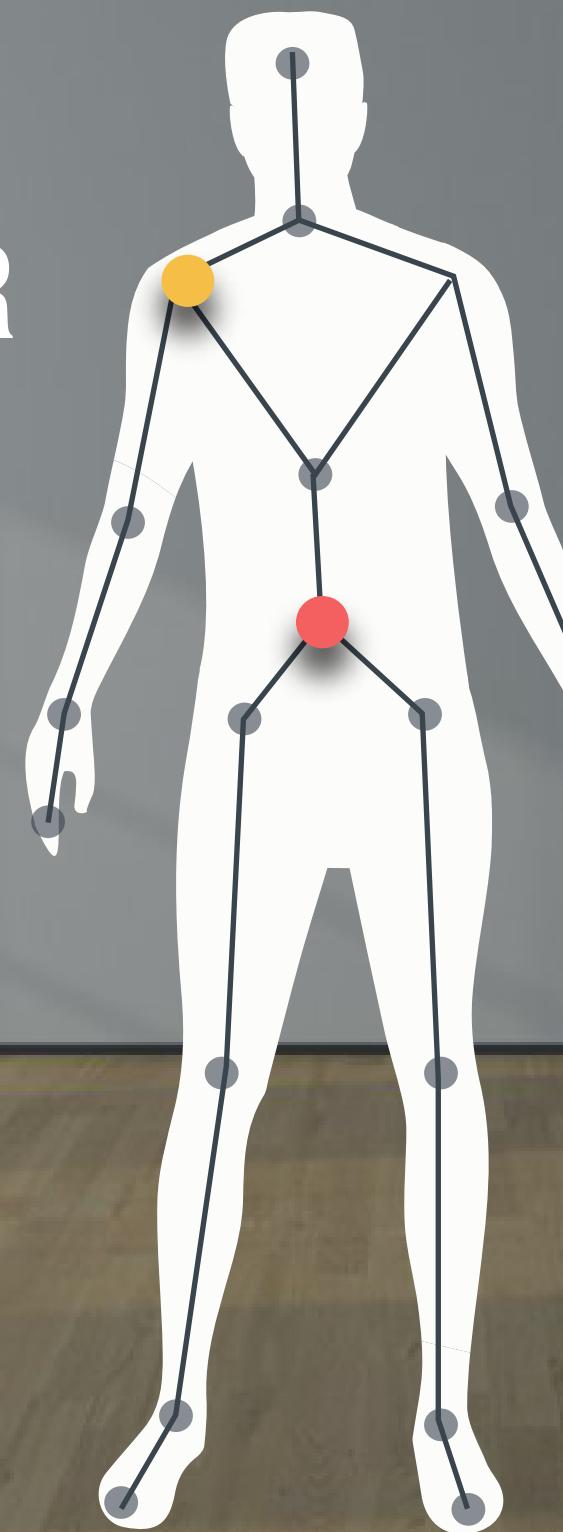
GAMES

SESSION PERFORMANCE

AFFECTED JOINTS

SHOULDER

HIP



MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE

RIGHT SHOULDER



MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE

RIGHT SHOULDER

IDEAL RANGE



MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE

RIGHT SHOULDER

YOUR RANGE



[MENU](#)

[SWIPE UP TO QUIT](#)

[GAMES](#)

SESSION PERFORMANCE

RIGHT SHOULDER



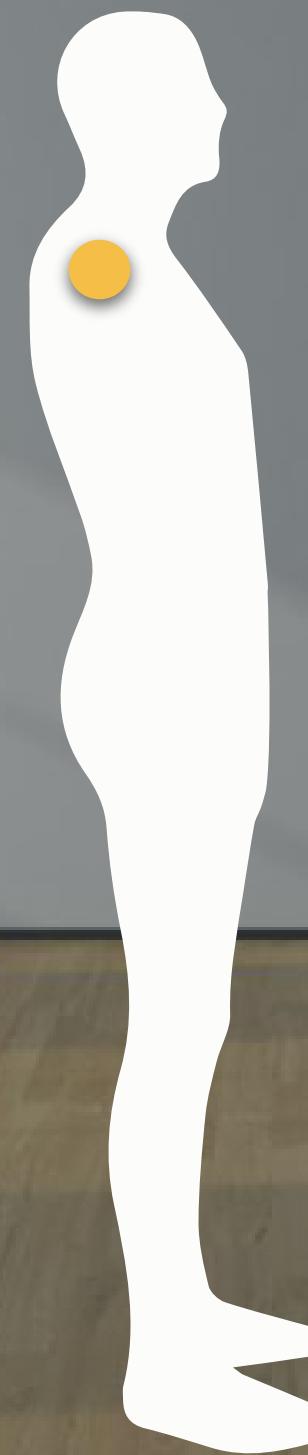
MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE

RIGHT SHOULDER



MENU

SWIPE UP TO QUIT

GAMES

SESSION PERFORMANCE



IDEAL RANGE



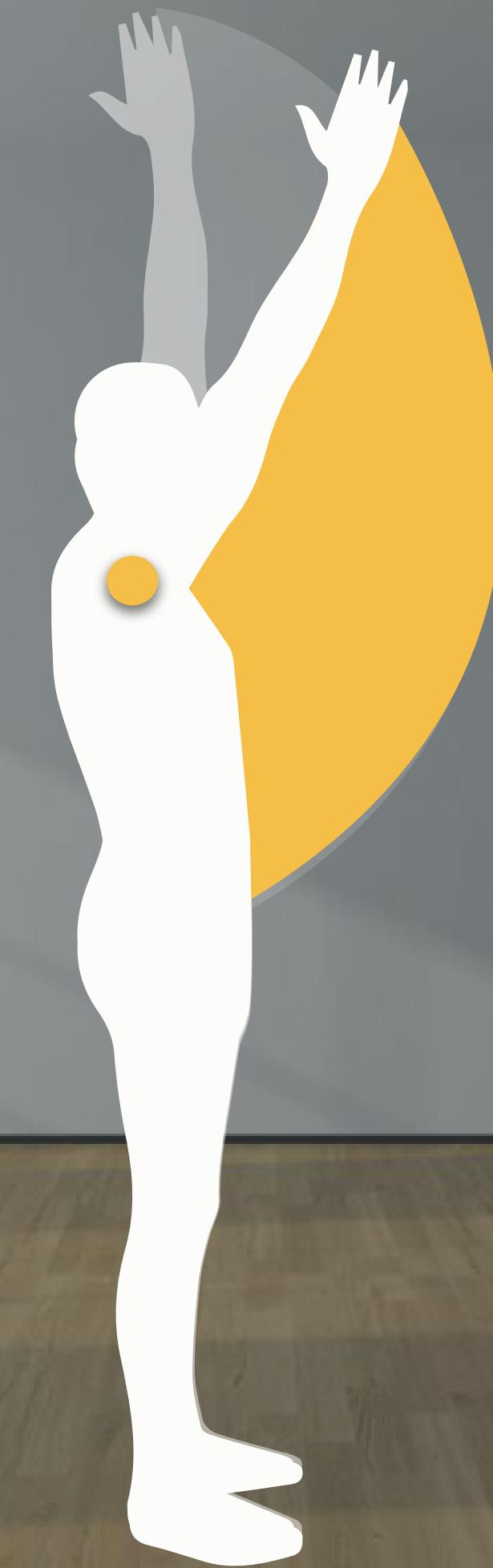
MENU

SWIPE UP TO QUIT



GAMES

SESSION PERFORMANCE



YOUR RANGE



MENU

SWIPE UP TO QUIT

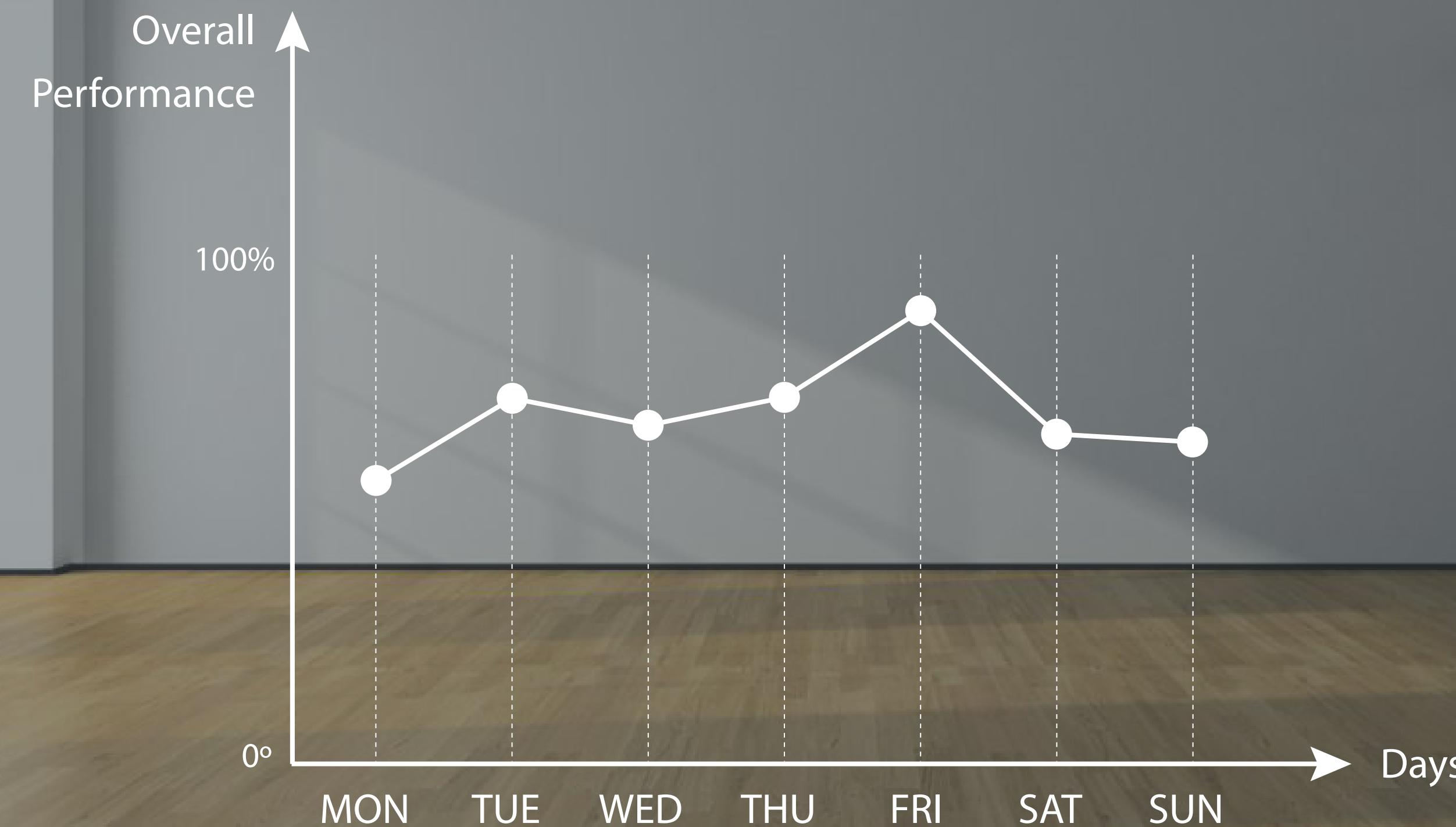
GAMES



DAY 7

WEEKLY SESSION PERFORMANCE

OVERALL PERFORMANCE vs DAY



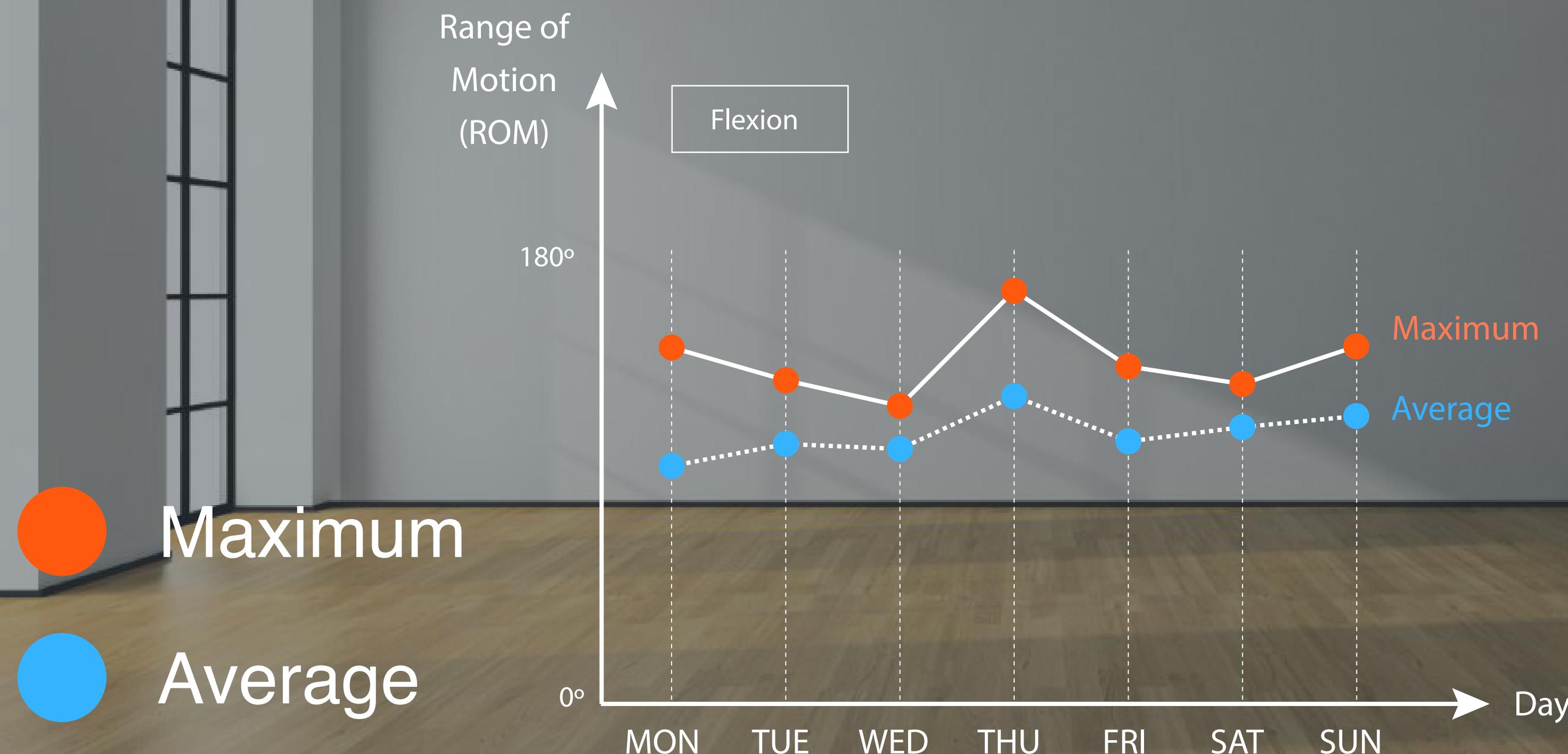
MENU

SWIPE UP TO QUIT

GAMES

WEEKLY SESSION PERFORMANCE

RANGE OF MOTION vs DAY



Maximum

Average

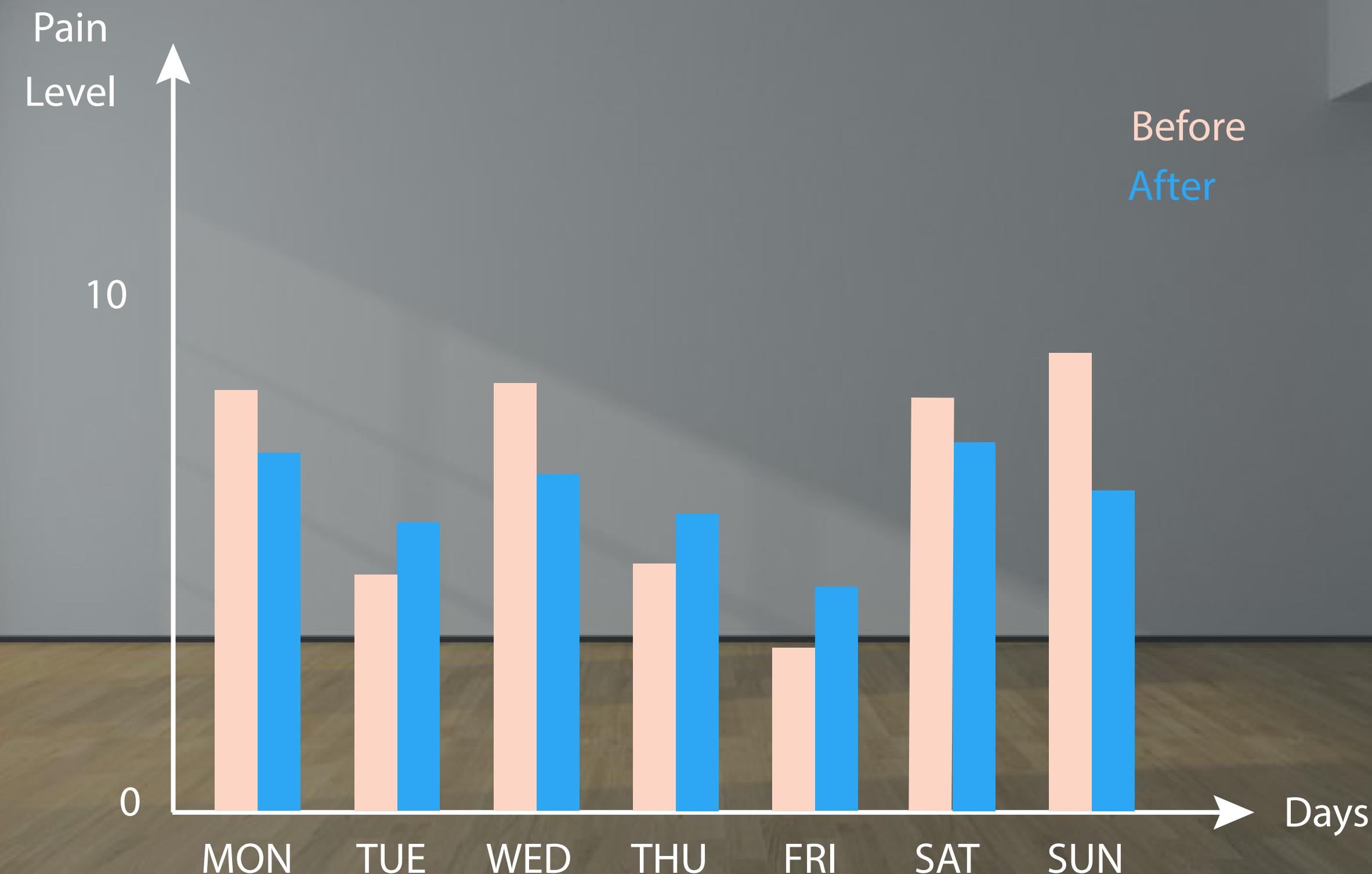
MENU

SWIPE UP TO QUIT

GAMES

WEEKLY SESSION PERFORMANCE

PAIN LEVEL vs DAYS



MENU

SWIPE UP TO QUIT

GAMES

GAMES

SWIPE UP TO QUIT



TO EXERCISE

RAISE LEFT HAND

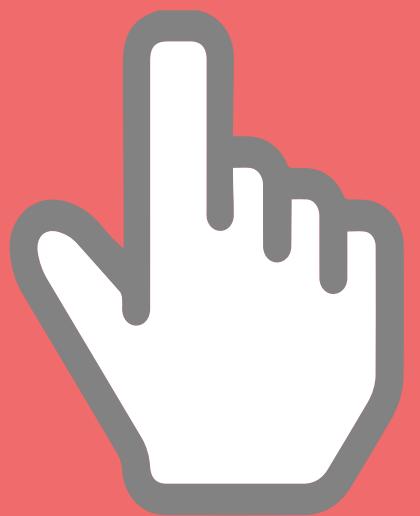
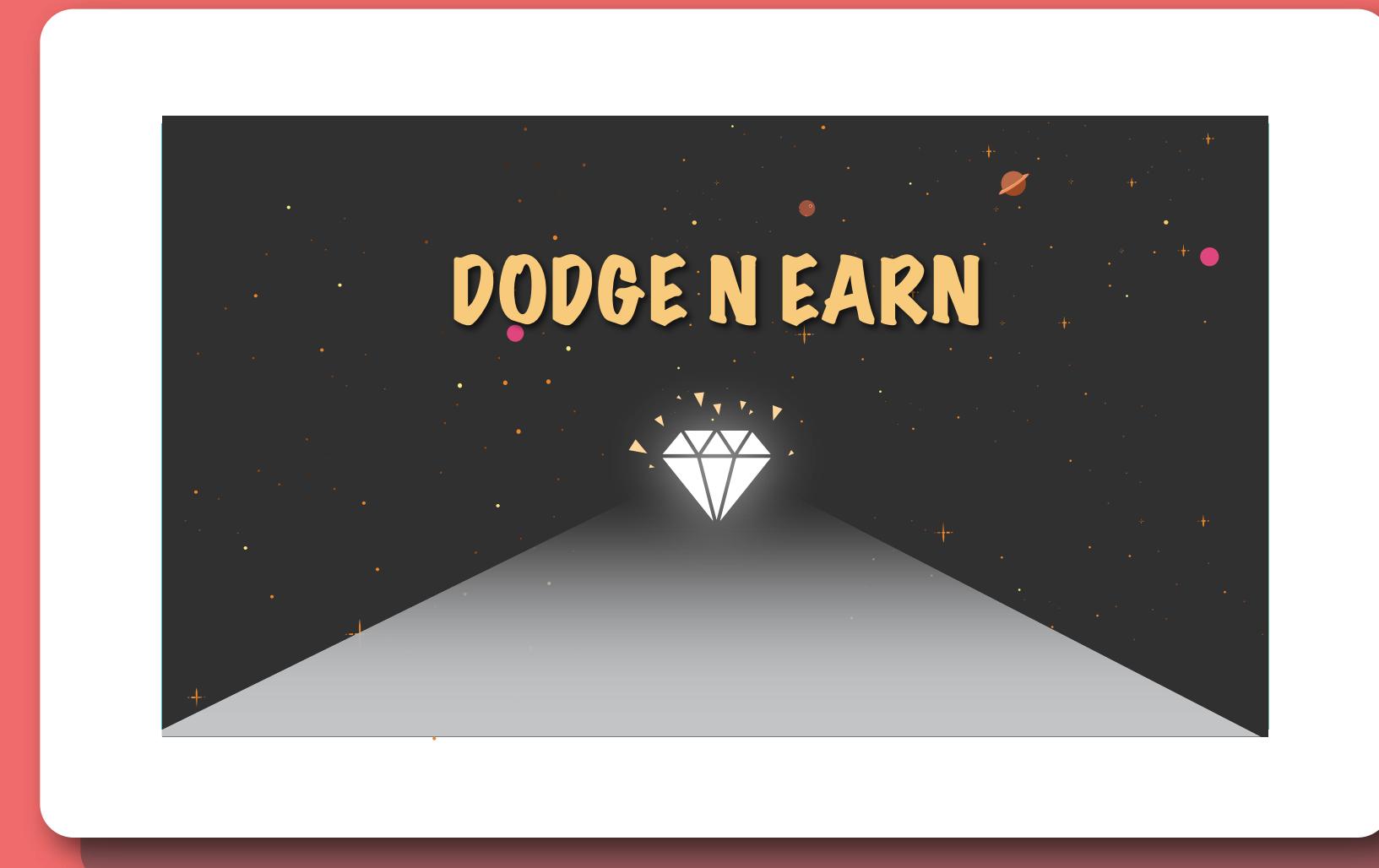
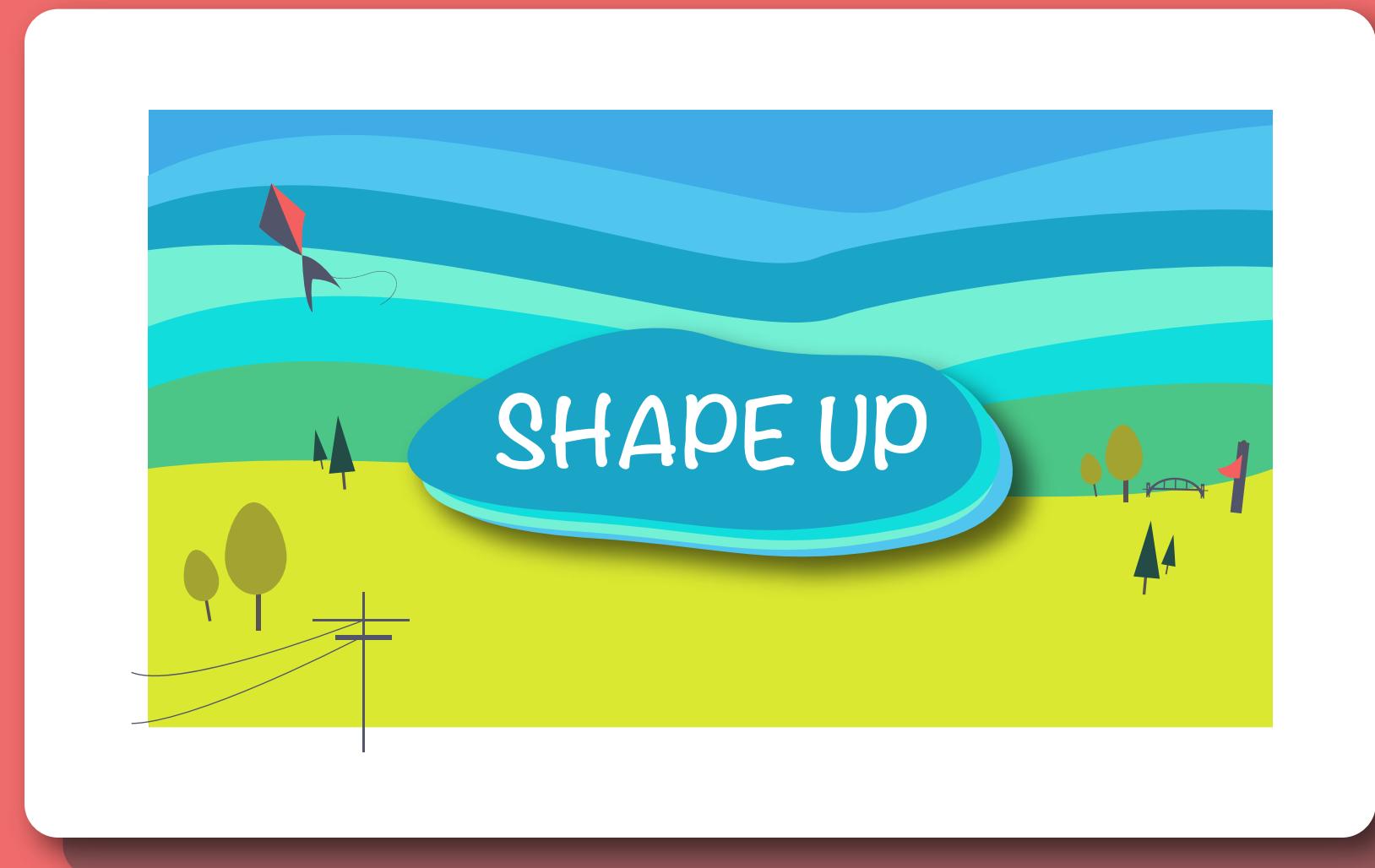


TO PLAY GAMES

RAISE RIGHT HAND



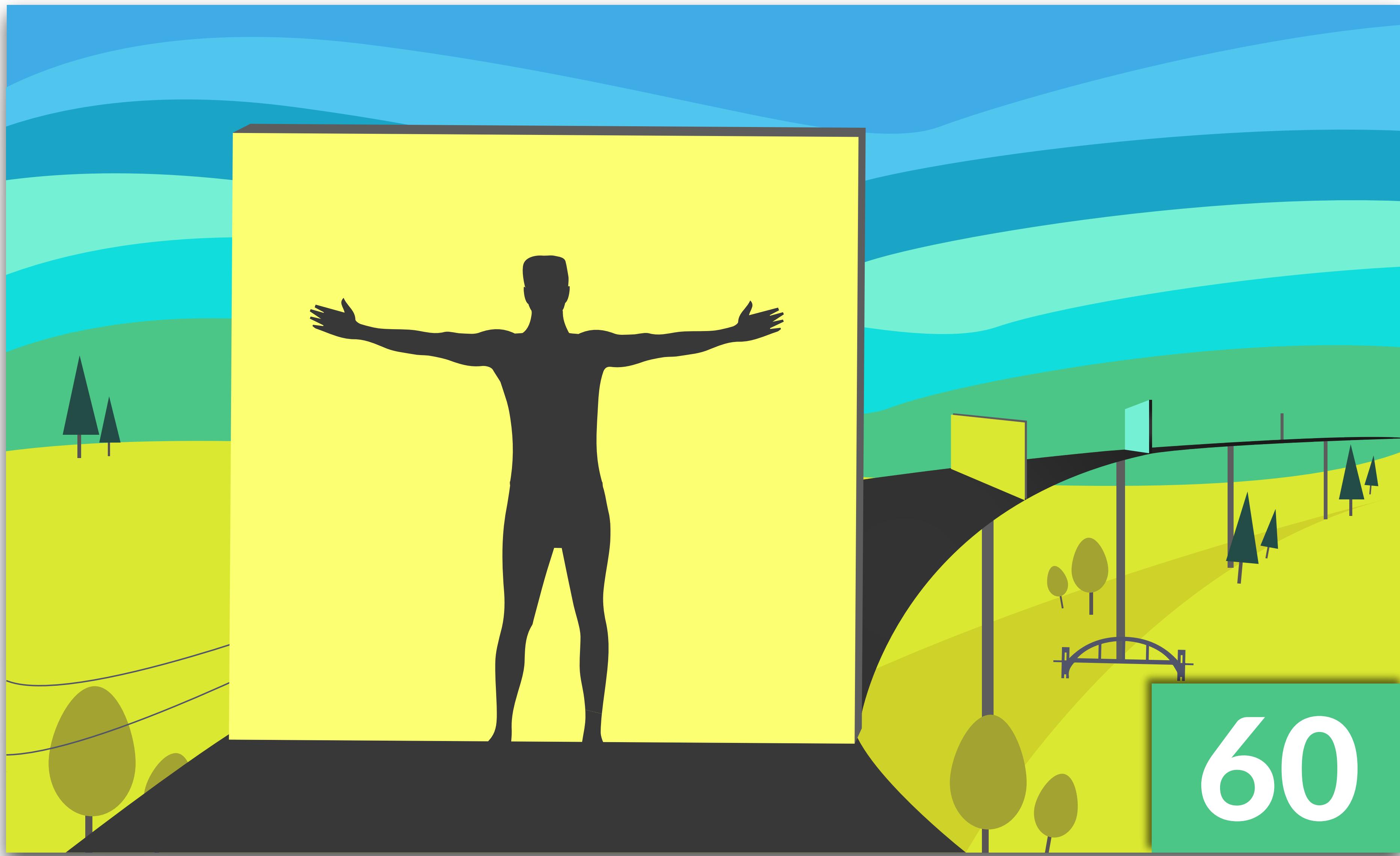
FOR HISTORY SWIPE DOWN

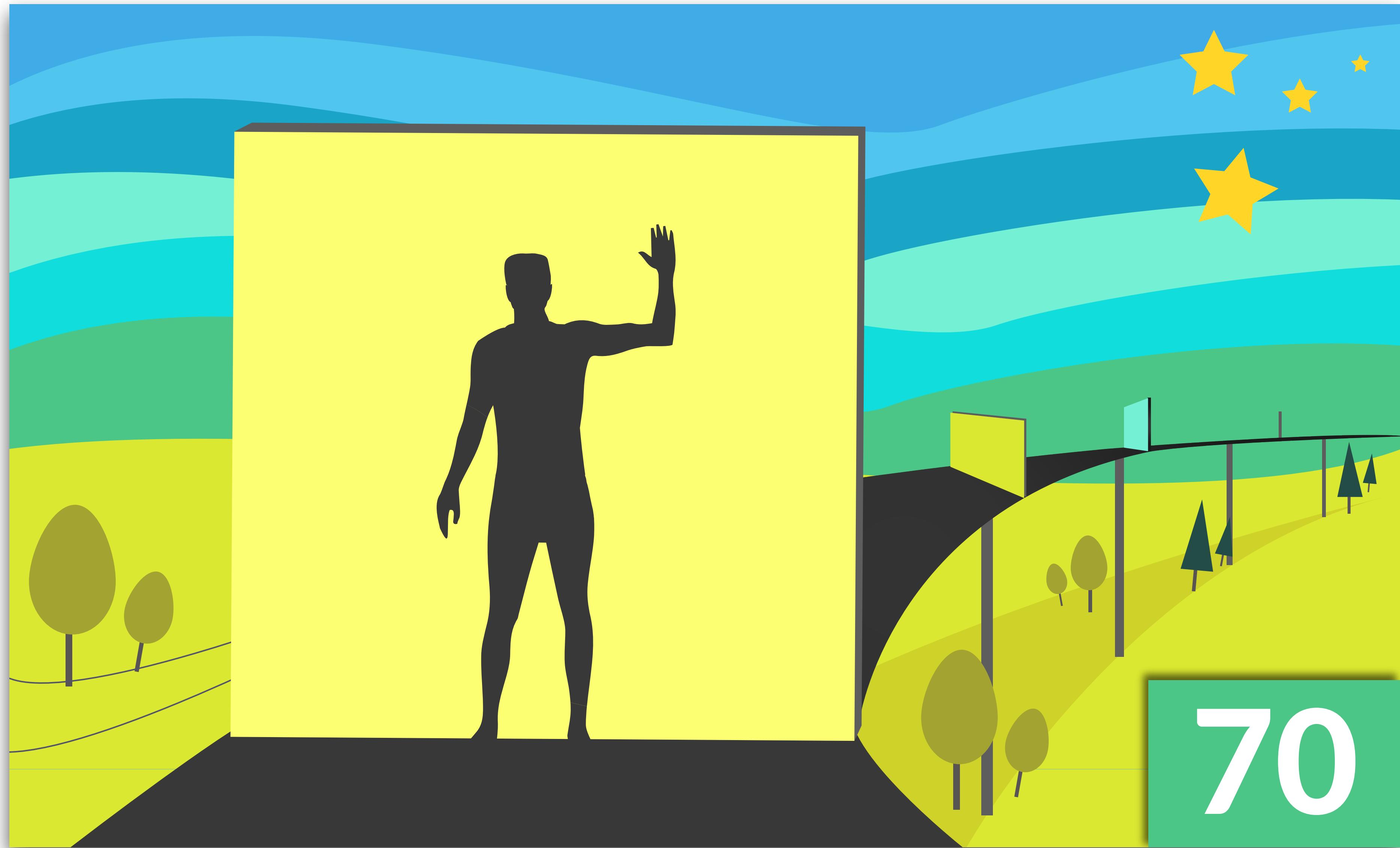




SHAPE UP

WAVE TO START

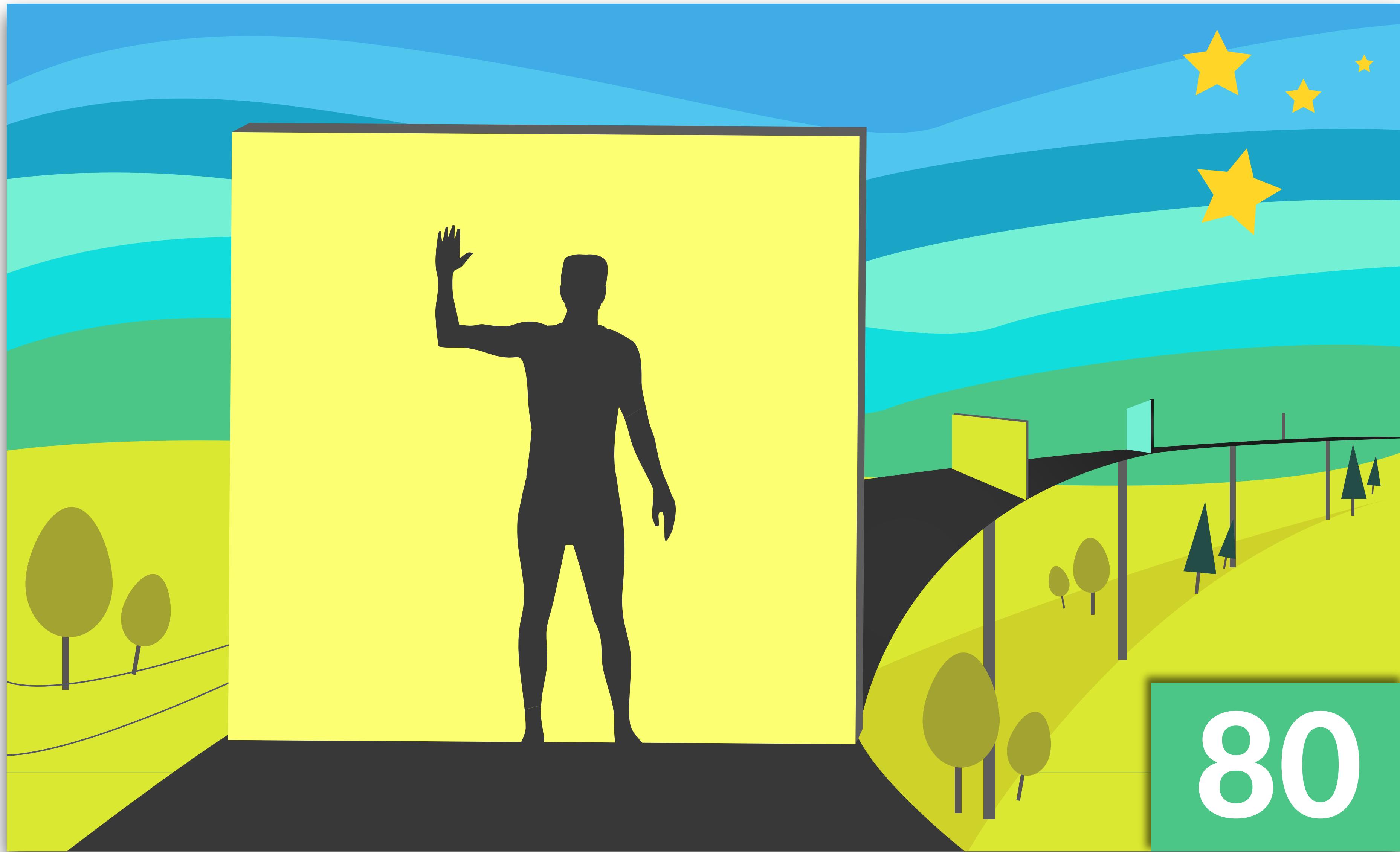


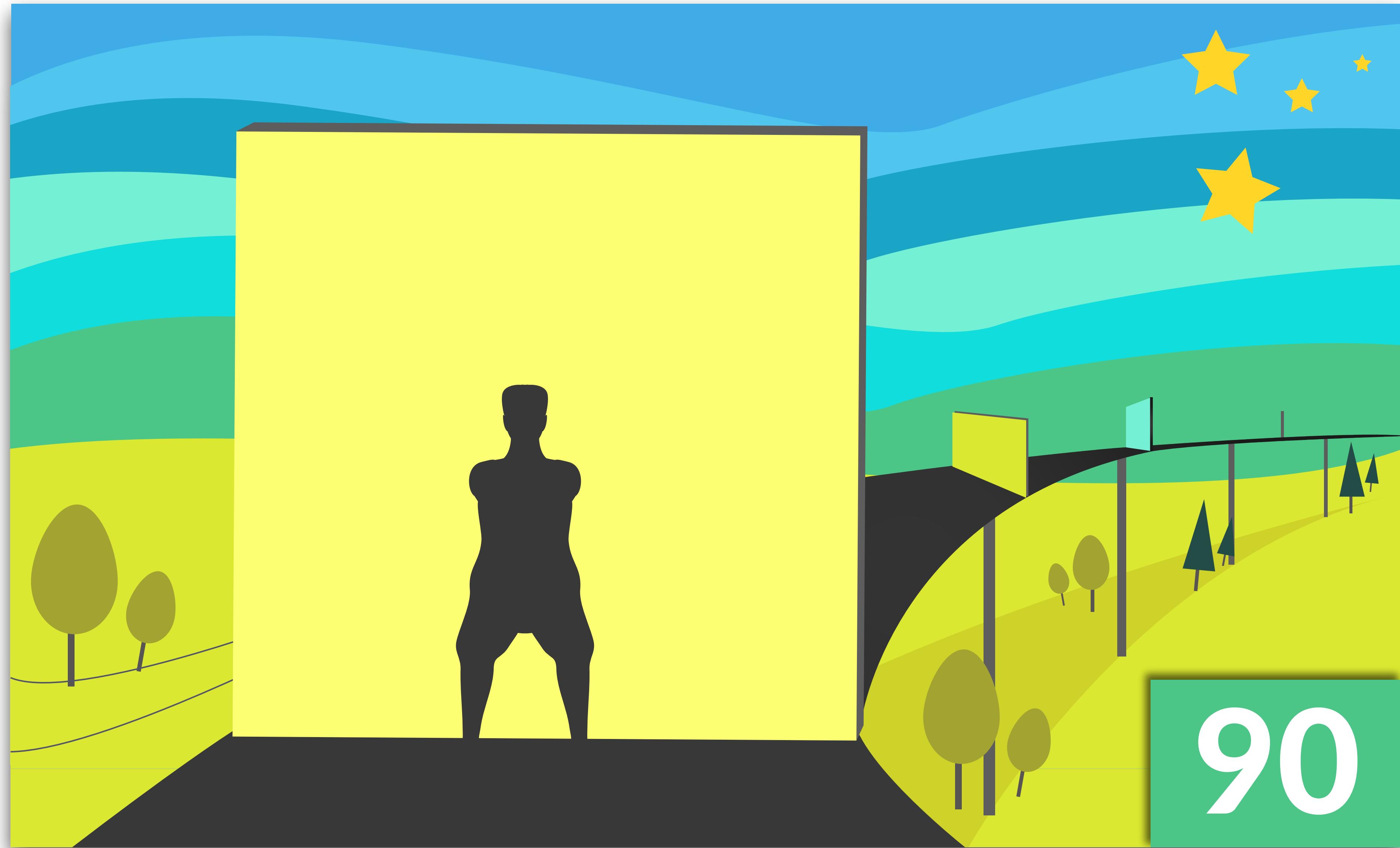


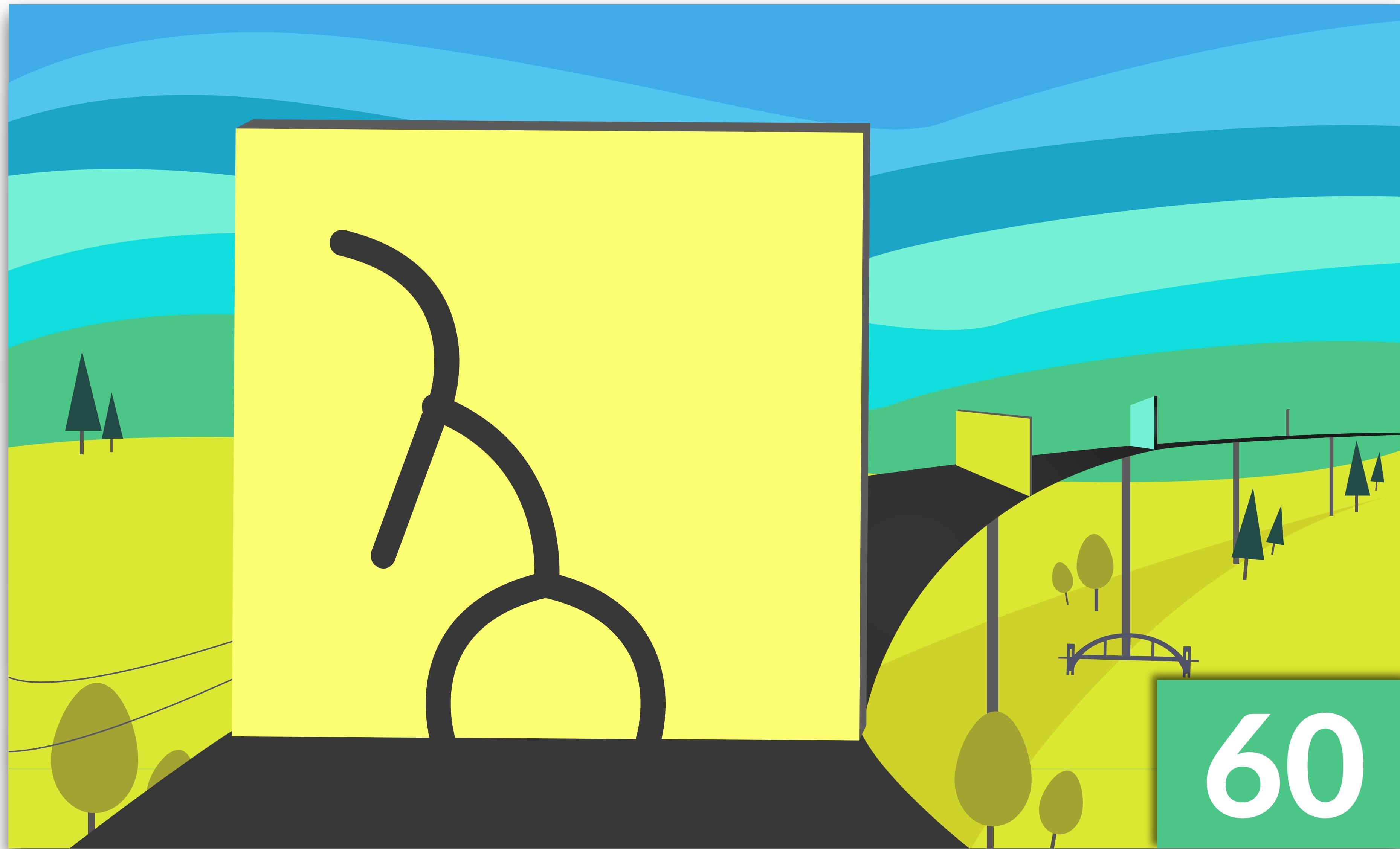
TRY AGAIN!!



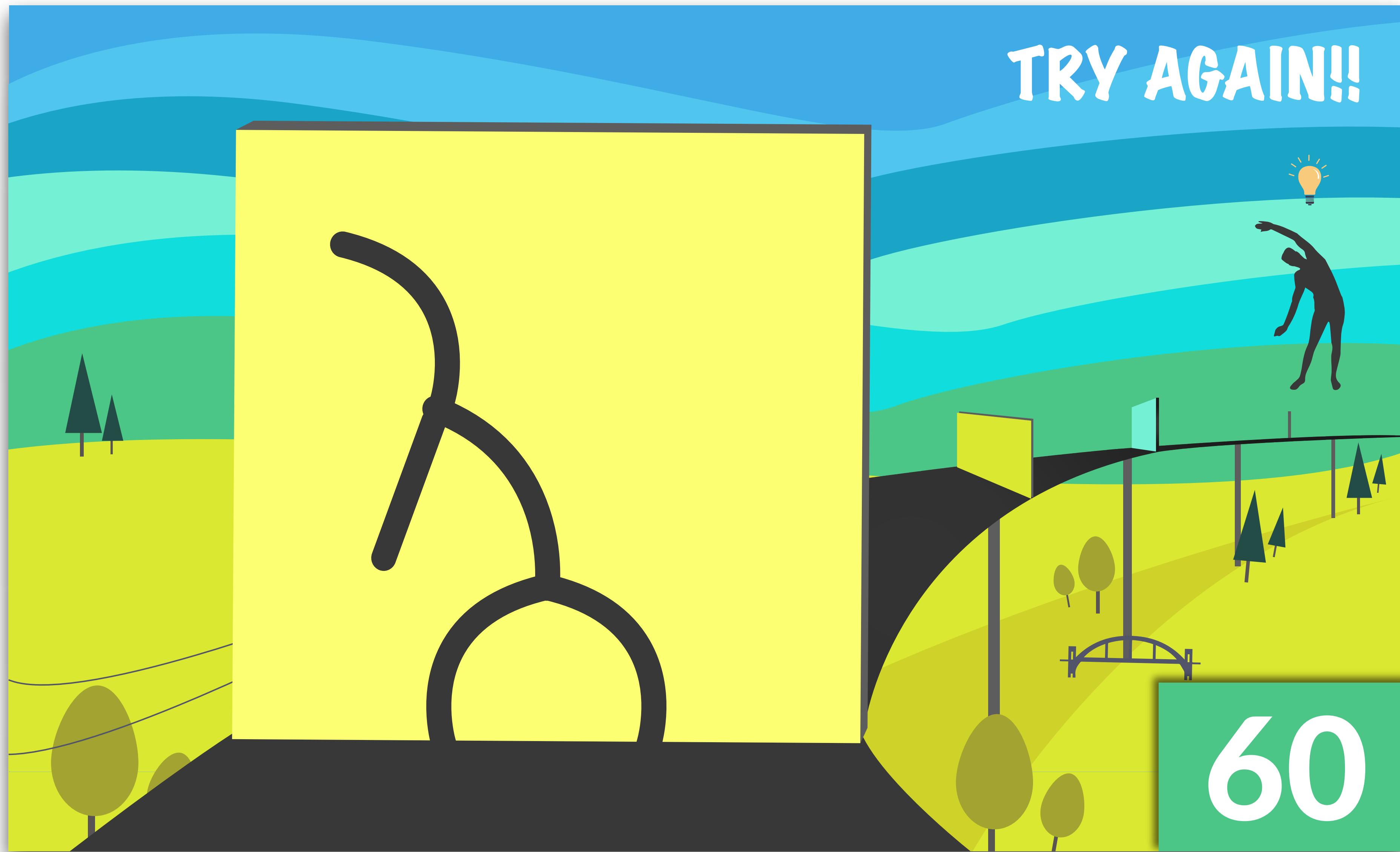
80

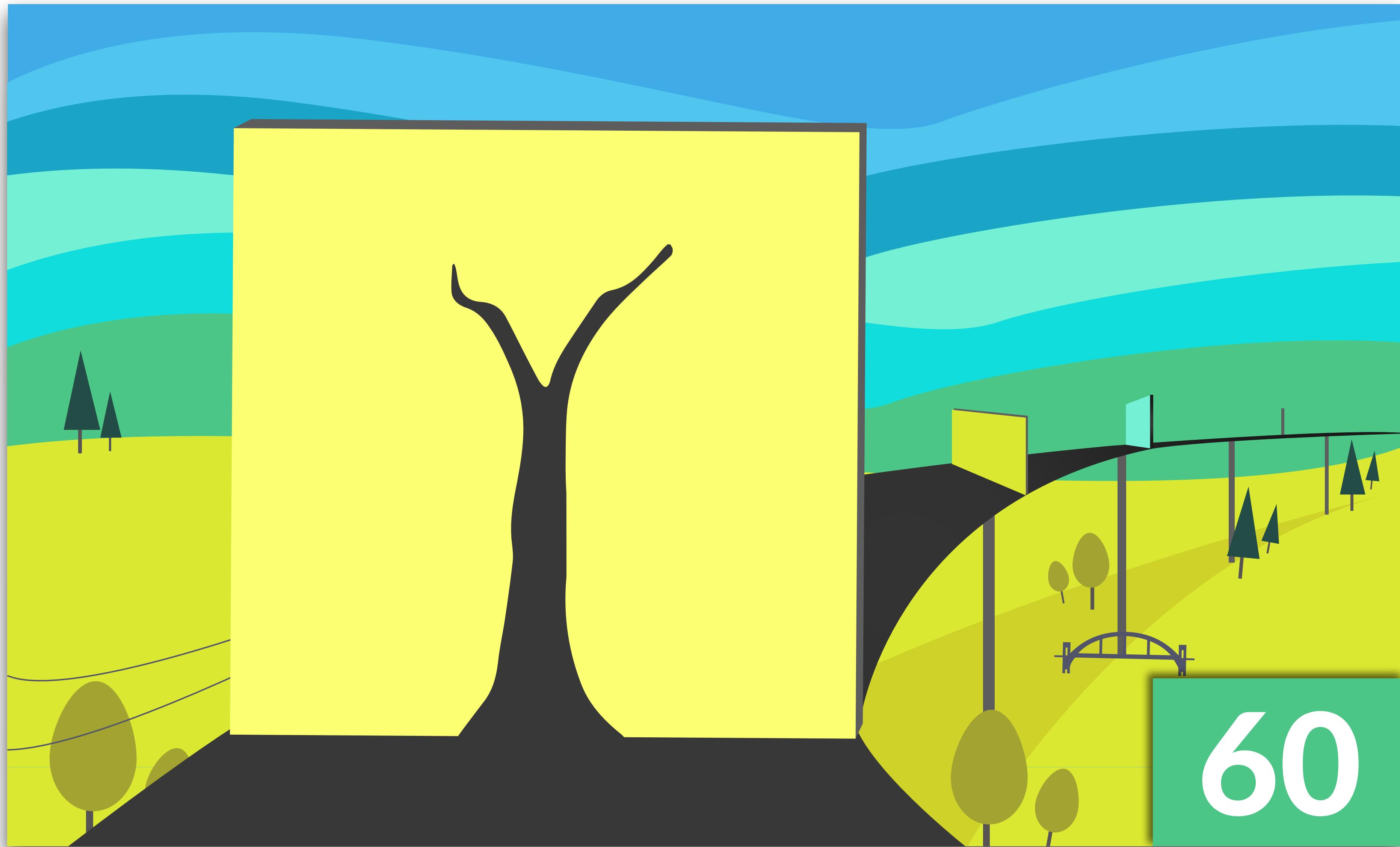




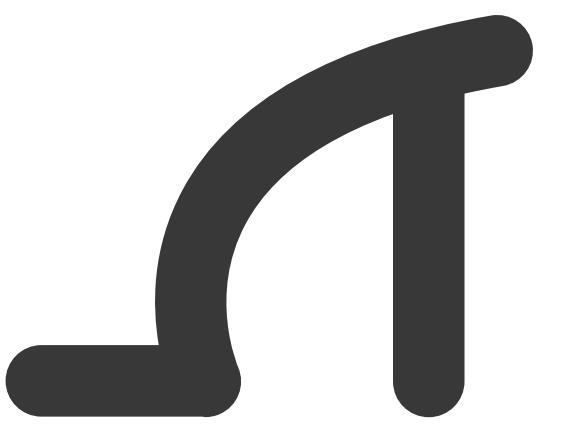
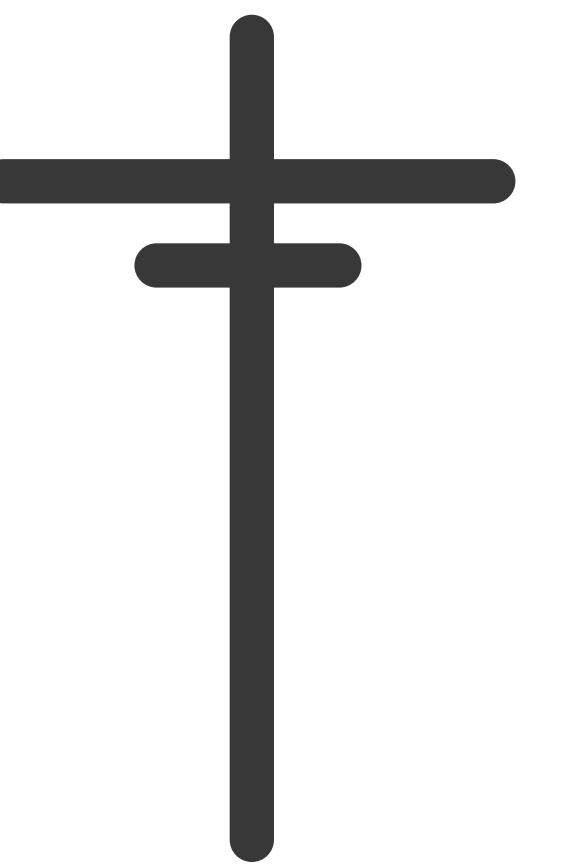
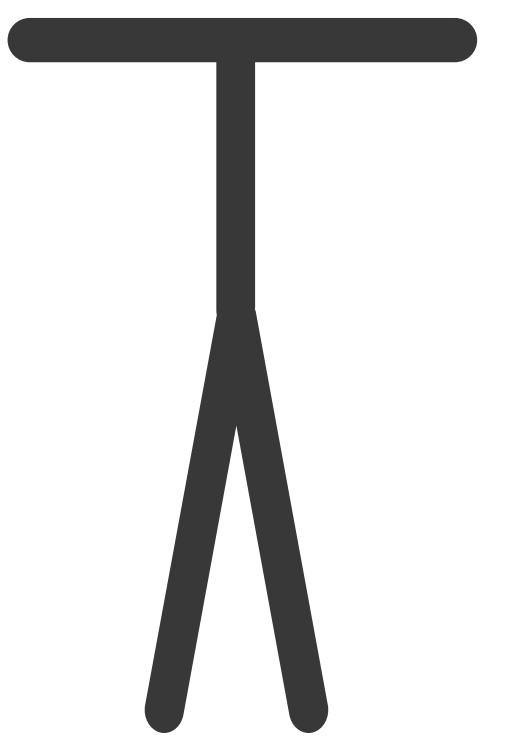
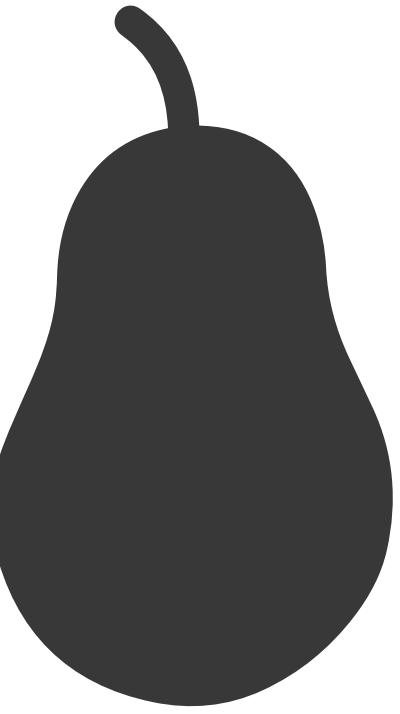
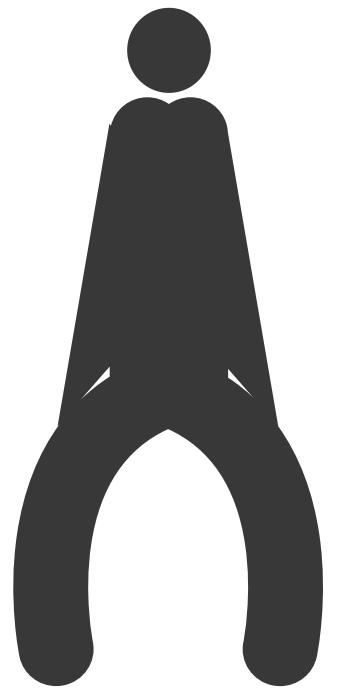
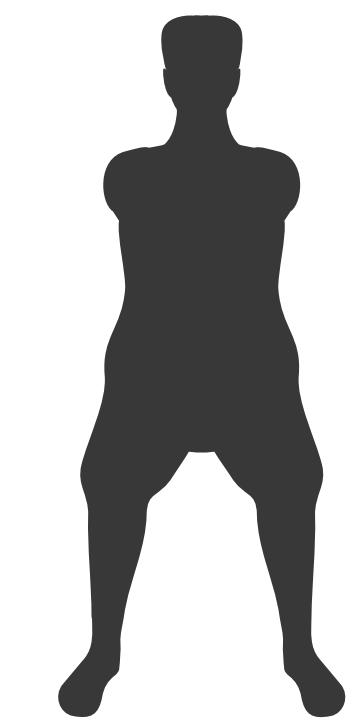
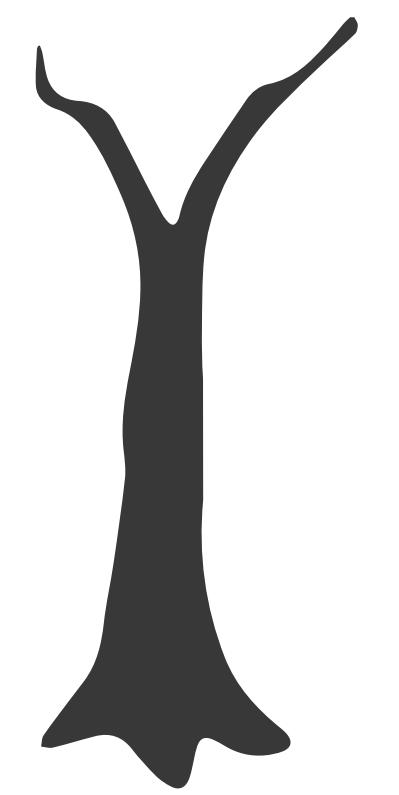
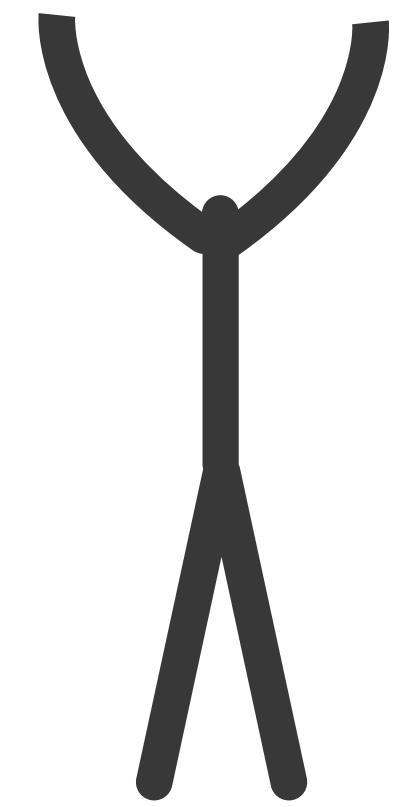
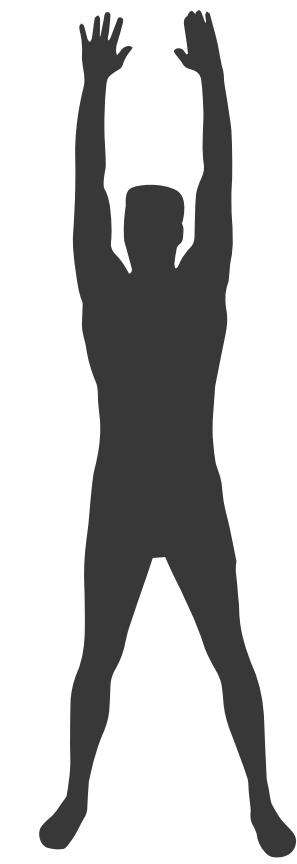


TRY AGAIN!!



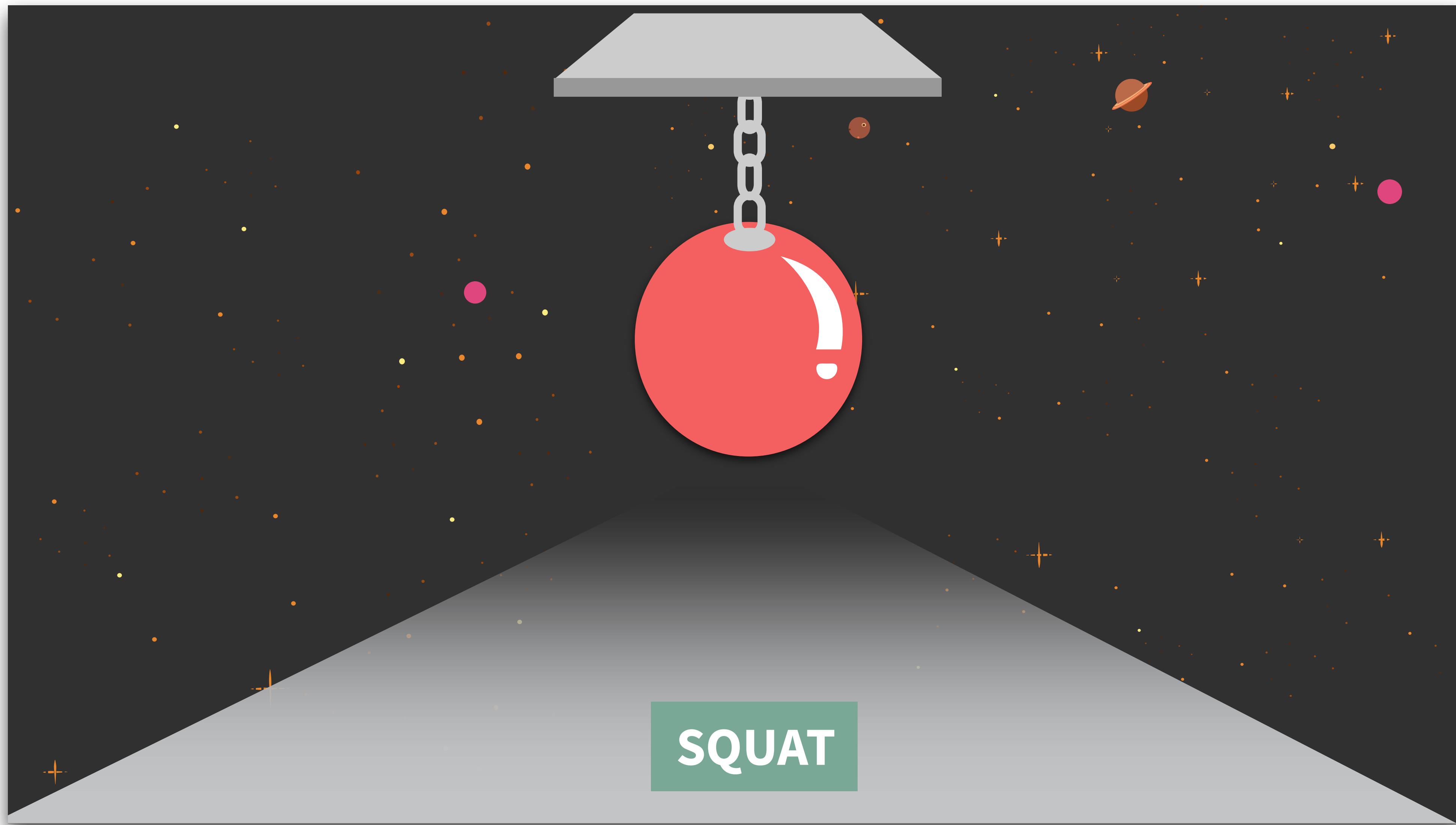


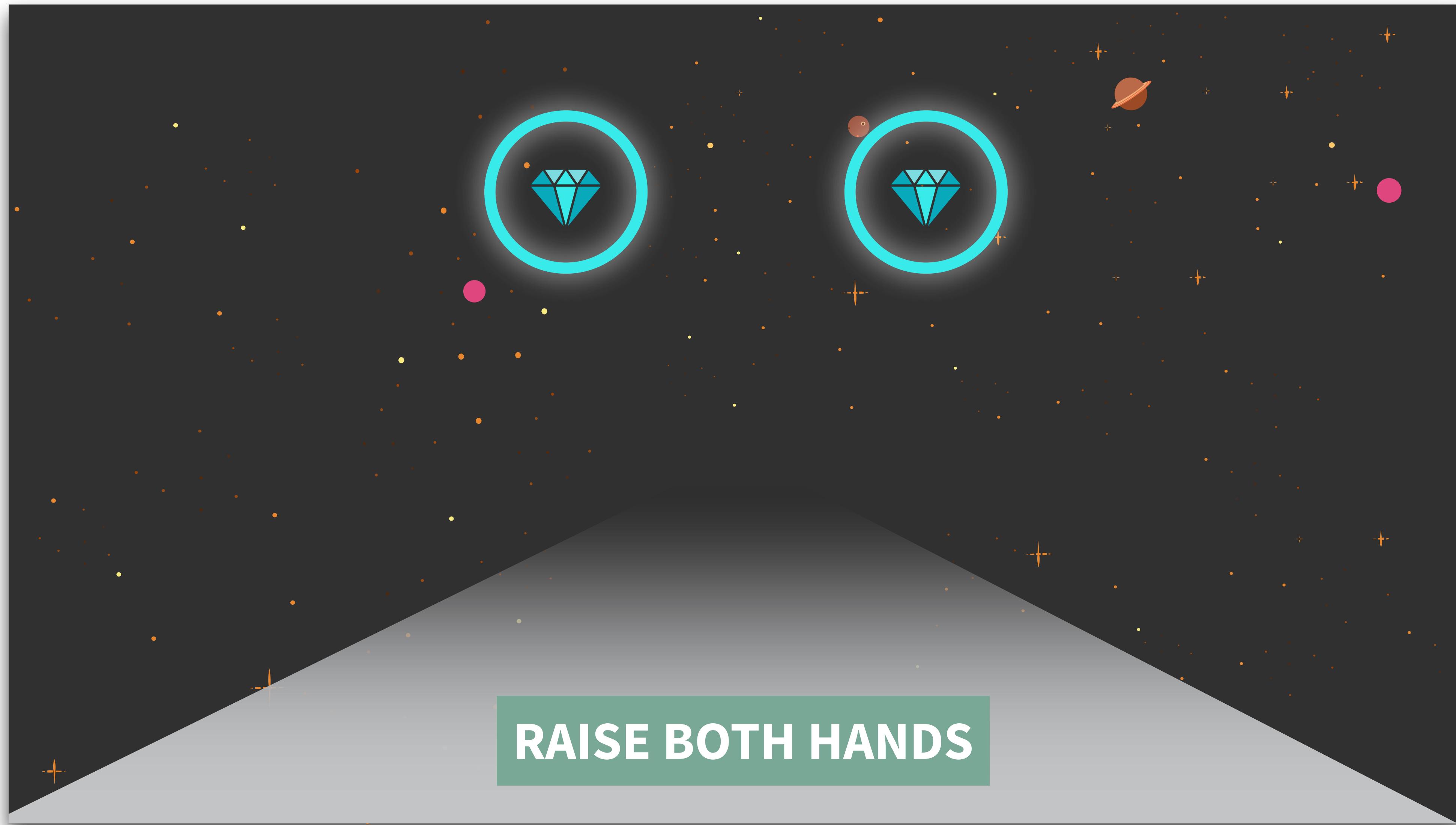


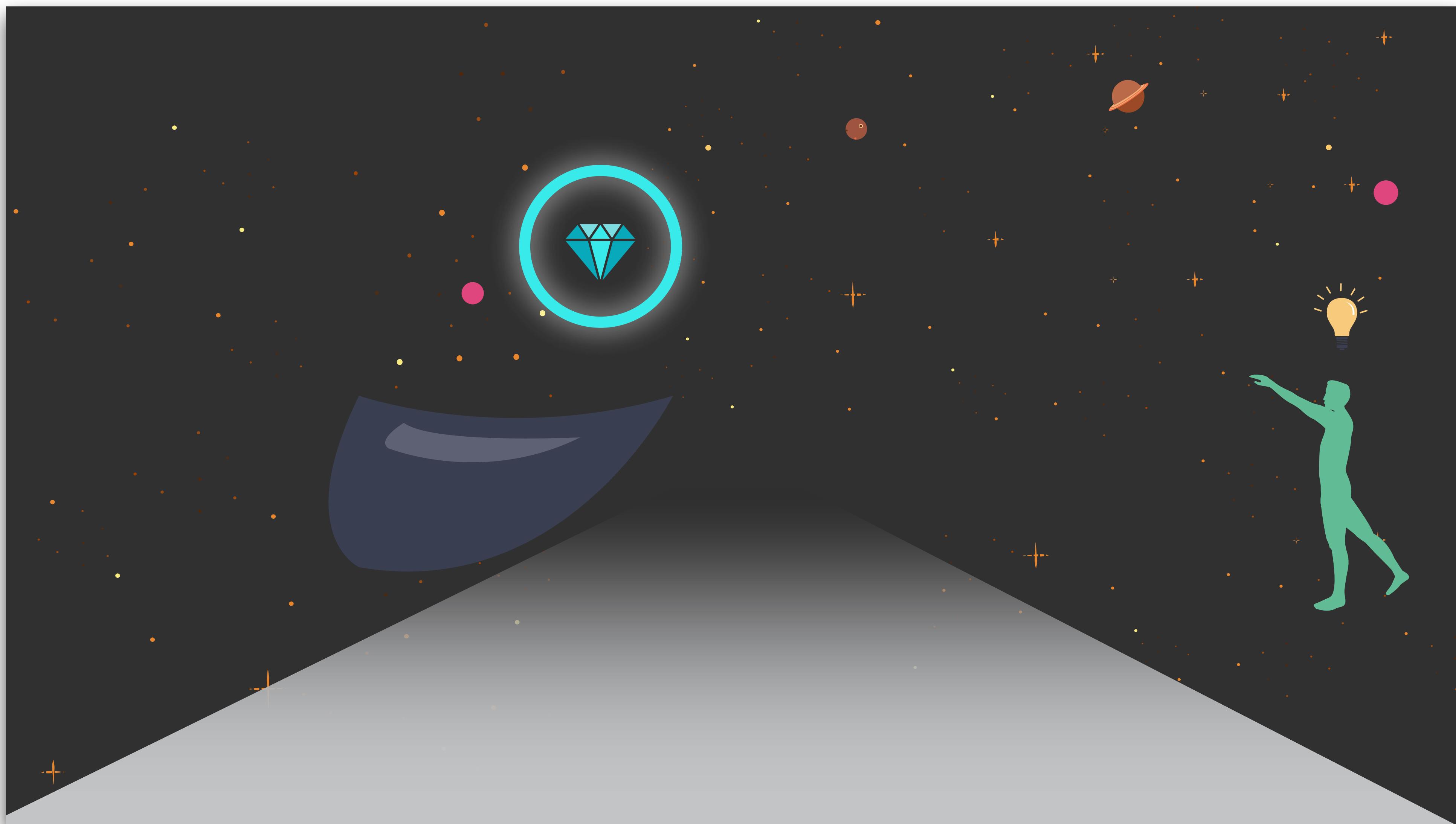


DODGE N EARN









PHYSIOTHERAPIST

Patients

Search Patients

-  P. Bhaskar
Current Pain Level : 4
-  S. Sindhe
Current Pain Level : 0
-  Prativa S.
Current Pain Level : 2
-  Ratan R.
Current Pain Level : 2

Patient Details

Ratan R.
Current Pain Level : 2
Affected Joints - Right Shoulder, Left Shoulder, Hip

Severity : Medium Current Mode : **Semi Auto**
Gender : Male Update Span : **Biweekly**
Age : **33** Current BPM : **40**
Patient Since : **5 yrs** Avg Session Time : **14 mins**
Activity : Sometimes Overall Progress : **Improving**

Exercises Report

Supervision

Search Joints

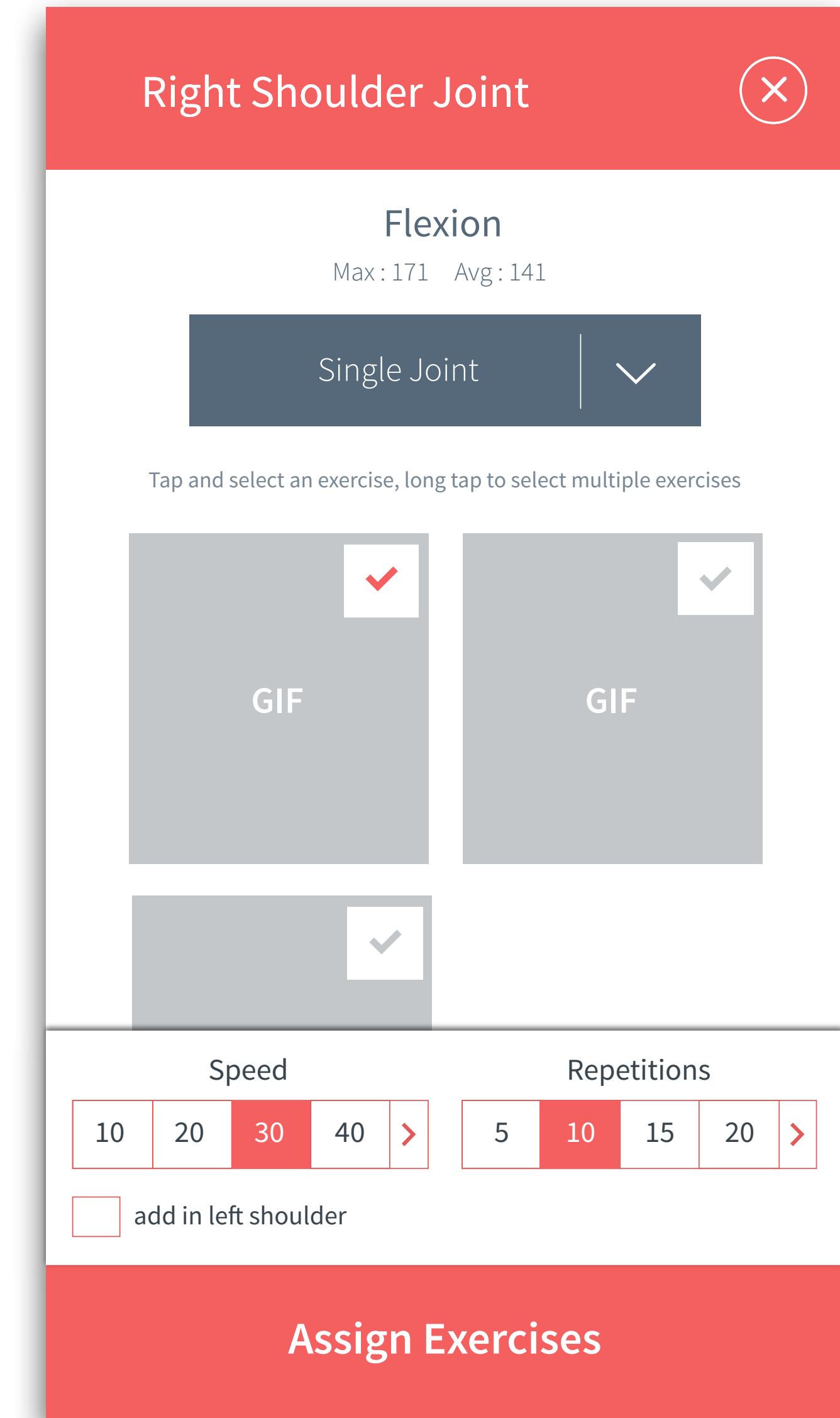
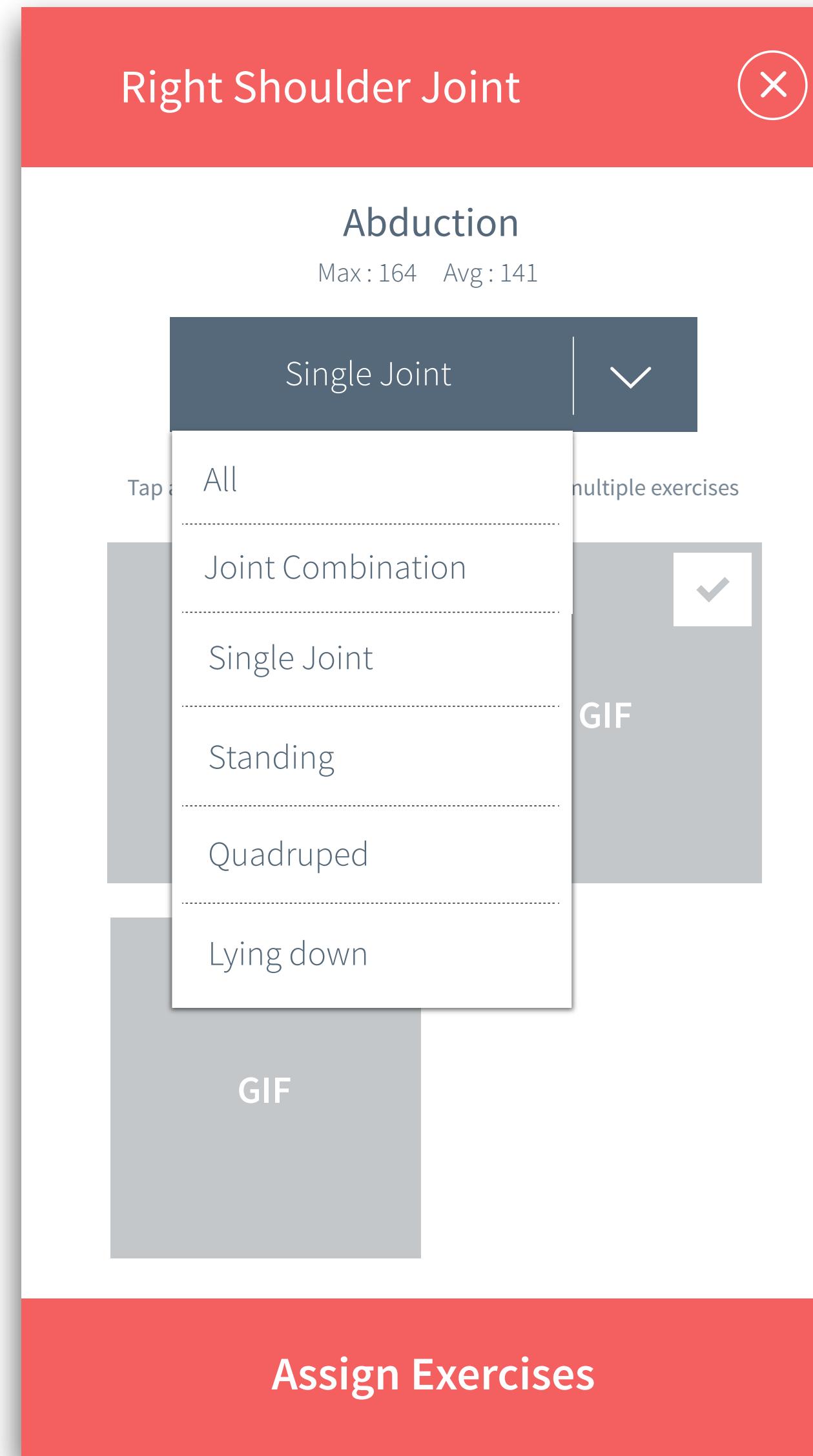
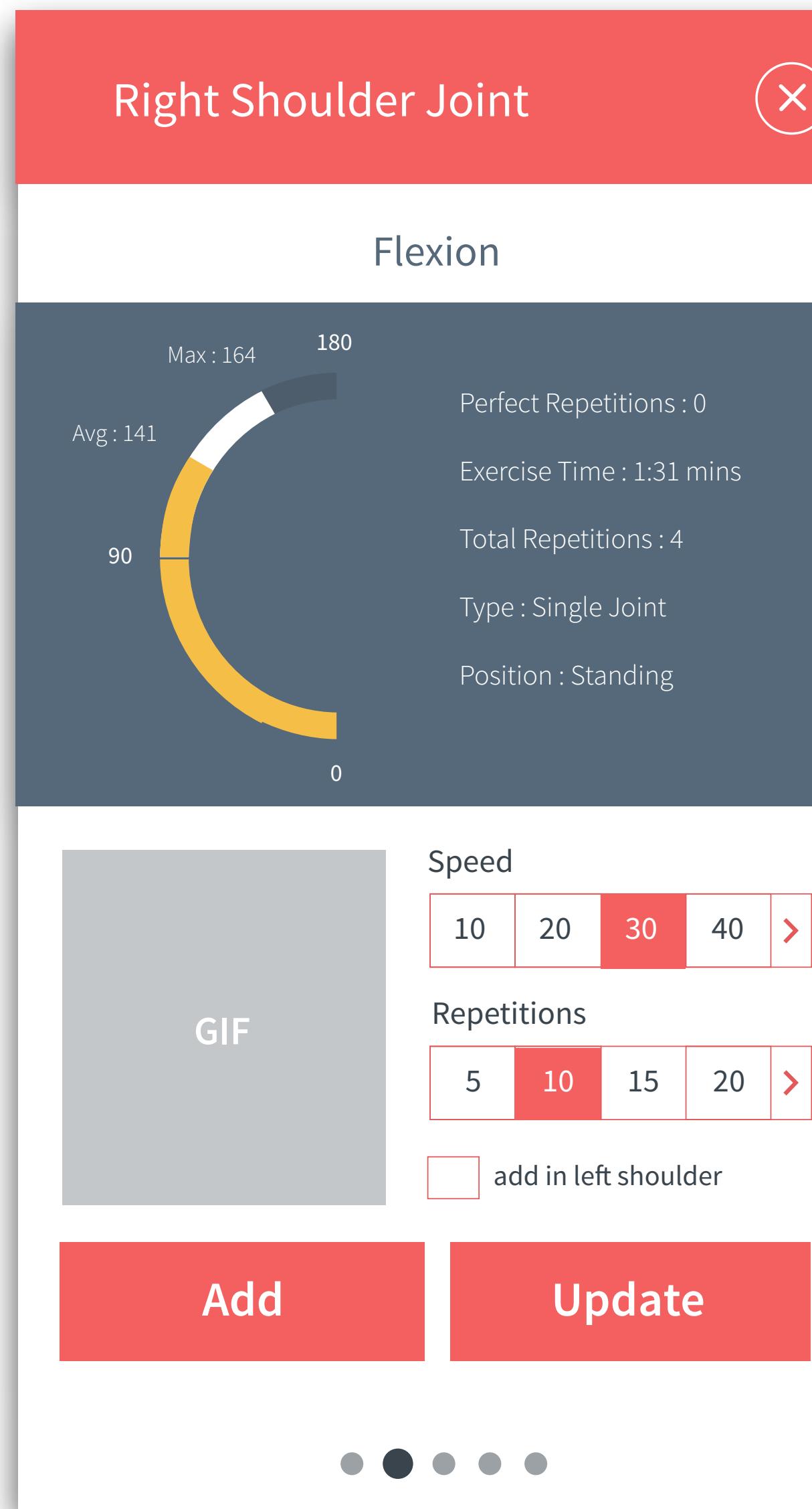
SEMI AUTO  WEEKLY 

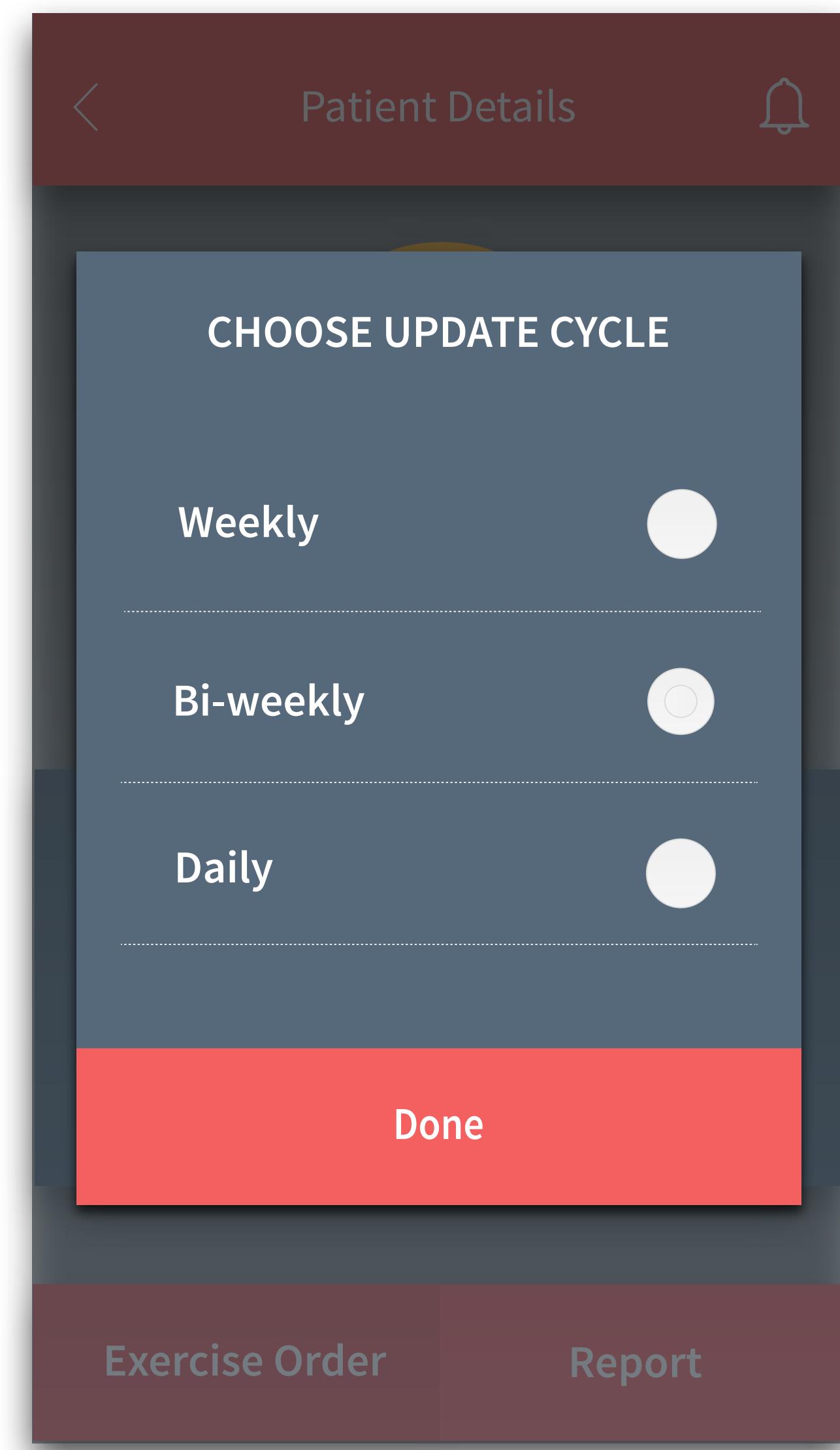
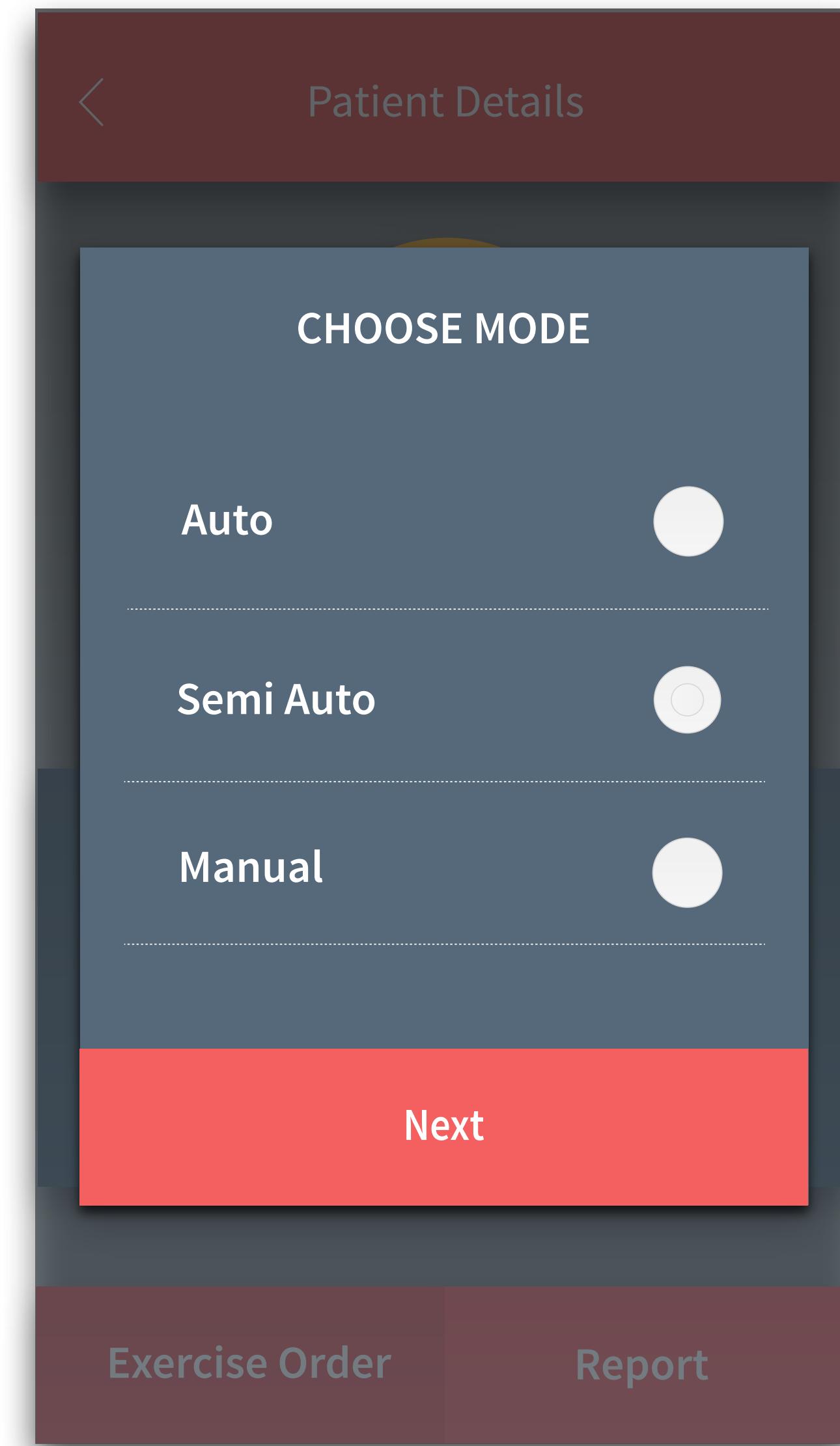
Neck 

Right Shoulder 

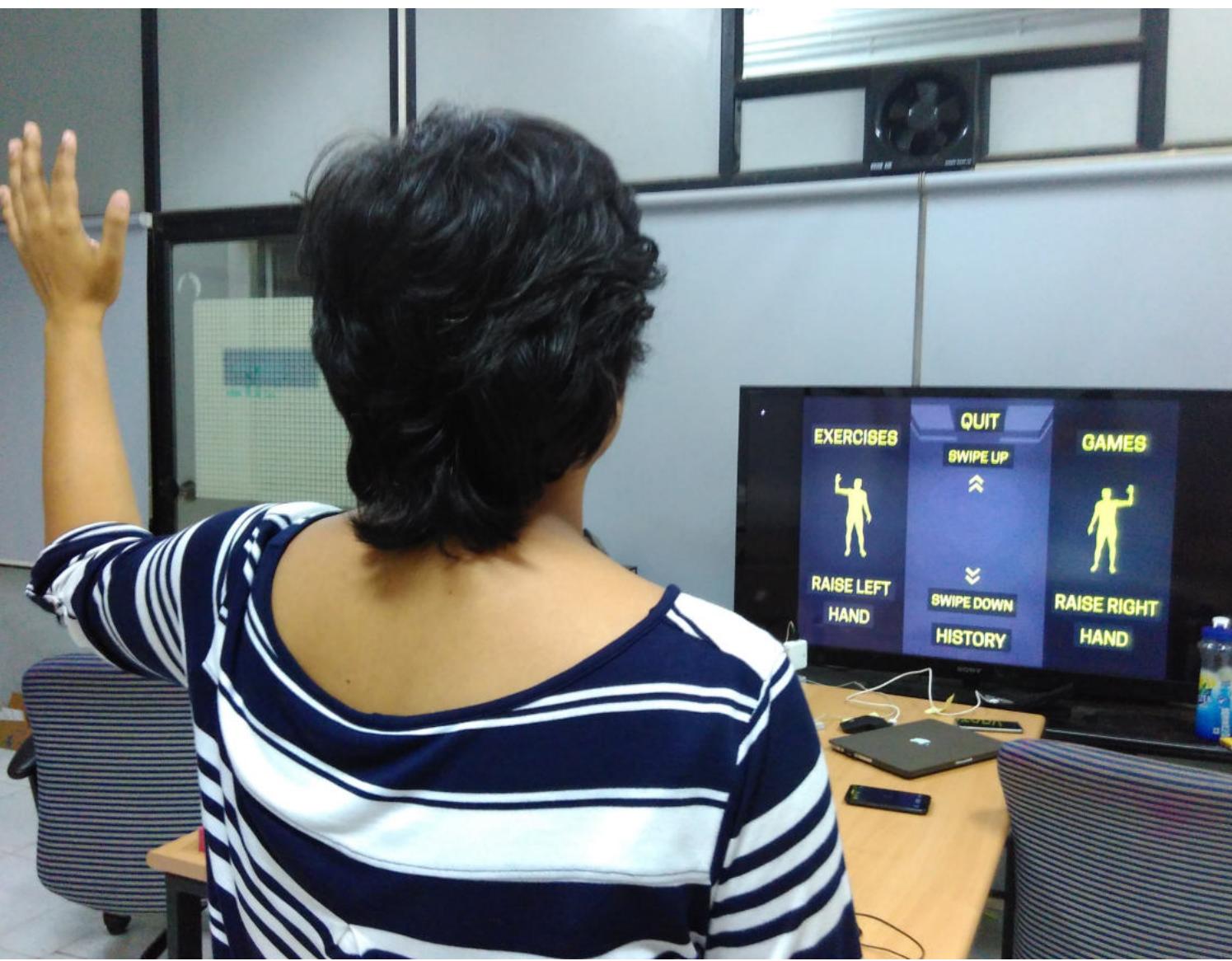
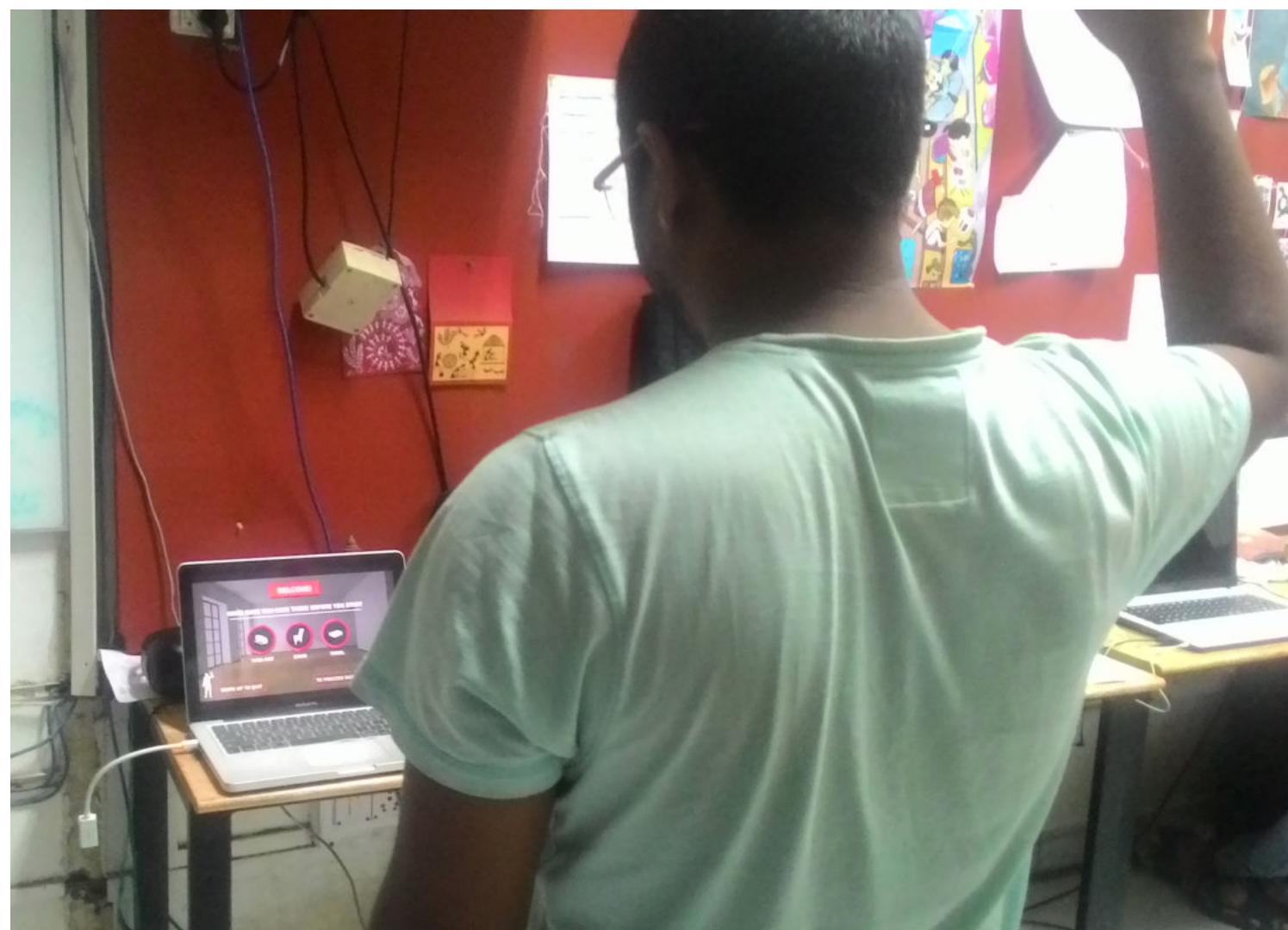
Left Shoulder 

Exercise Order Report





PATIENT FEEDBACK



Exercise Regime - Patients

- One patient start exercising in the demonstration screen itself.
- All patients will not be interested to view feedback for all joints.
- Patients interested in seeing feedback of affected joints only.
- Concern with the accuracy of the system initially.
- Improvement in range of motion (ROM) strong motivator.
- Patients interested to know the current ROM and improvements if any.
- Mostly comfortable in doing exercises alone.

Game - Patients

- Patients thought they played for 2-3 minutes or less.
- Current postures include only cardio.
- Patients were oblivious about the what the instructor was doing.
- Did not think about what posture would come next.
- Did not look at the tracking device.
- One patient could replicate chest rigidity sequence.
- All patients could mention at least one sequence of postures.
- Patients trying to match postures exactly.
- A report at the end of the session main motivator, should be included in games as well.

FUTURE WORK

Future Work

- Mobile application for patients to view and show session feedback, input pain level.
- Connecting therapist and patient without affecting the business model.
- Moderator (Admin) requirement study and its interfaces.
- Evaluating effect of posture abstraction on patient engagement and perception challenge.
- Eliminating prototyping tool drawbacks and filtering interaction challenges in therapist application.
- Implementing upload features (X-ray report, prescriptions) by patients.

PROTOTYPE

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