

Interactive Full Body Exercise Experience for People Affected with Ankylosing Spondylitis

Guide : Prof. Girish Dalvi

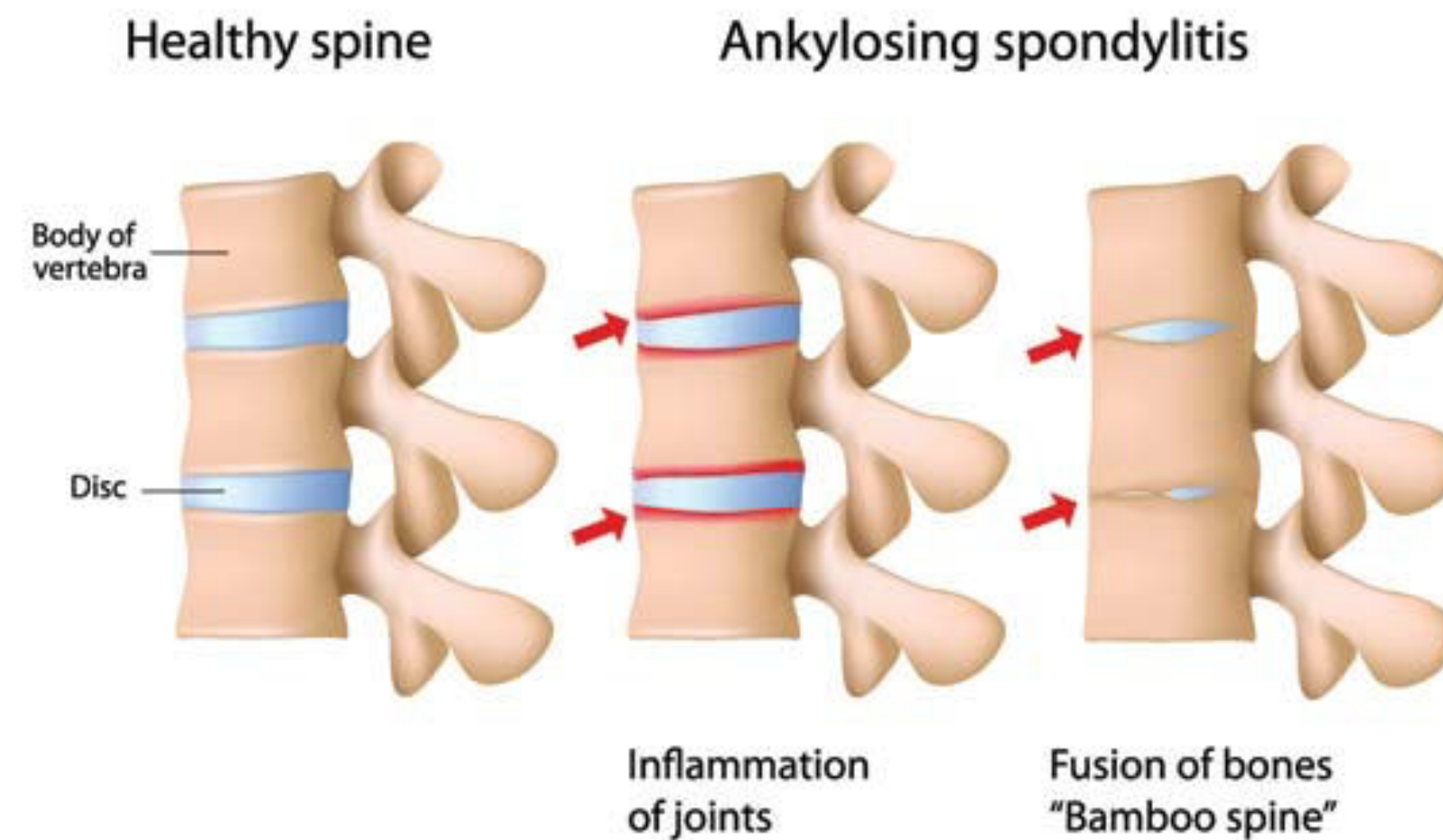
Jayati Bandyopadhyayl 146330004

What is Ankylosing Spondylitis

DEFINITION

Ankylose - become stiffened or united.

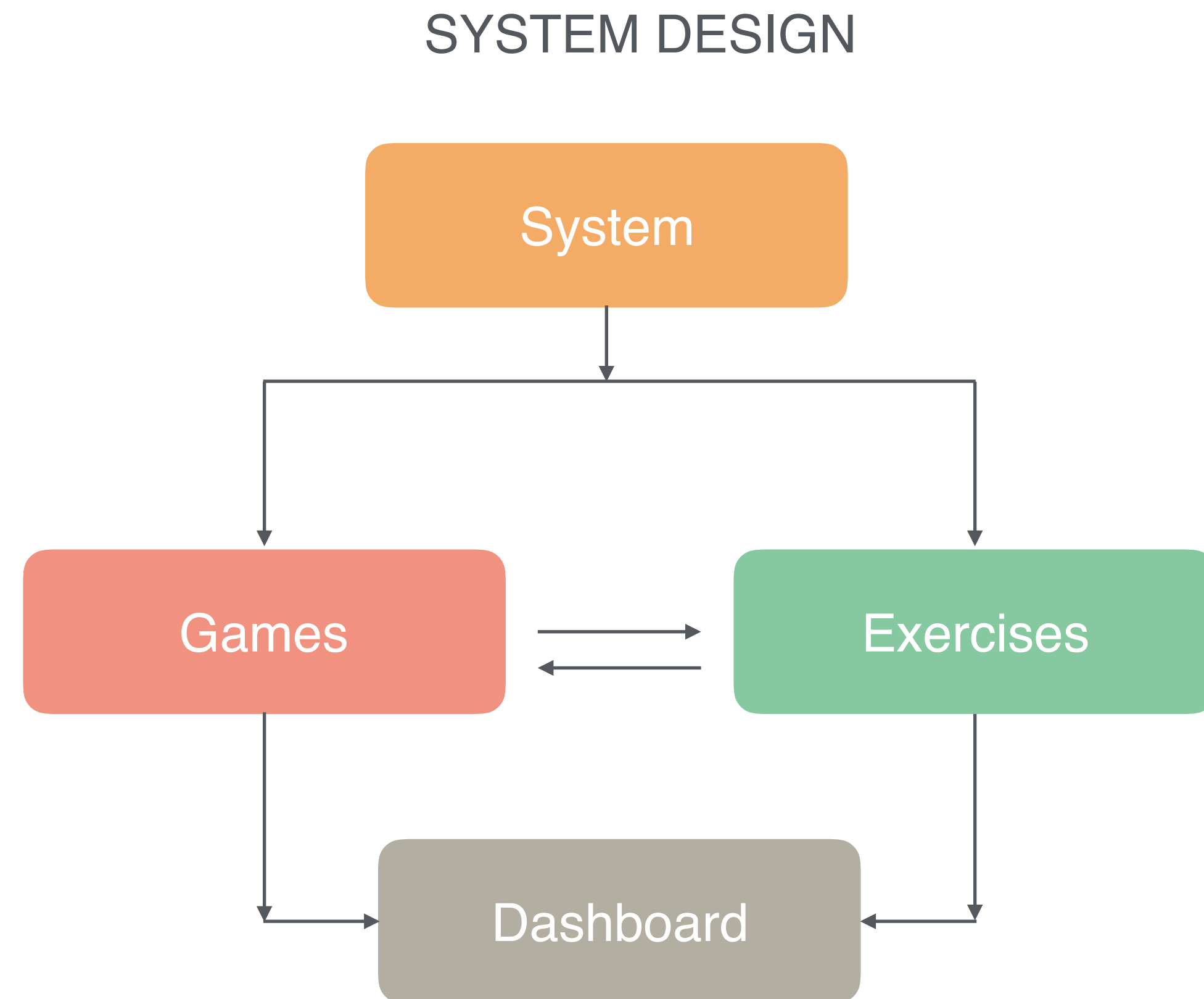
- Inflammatory rheumatic disease.
- Mainly affects the axial skeleton.
- Joint margins gradually ossify.



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.

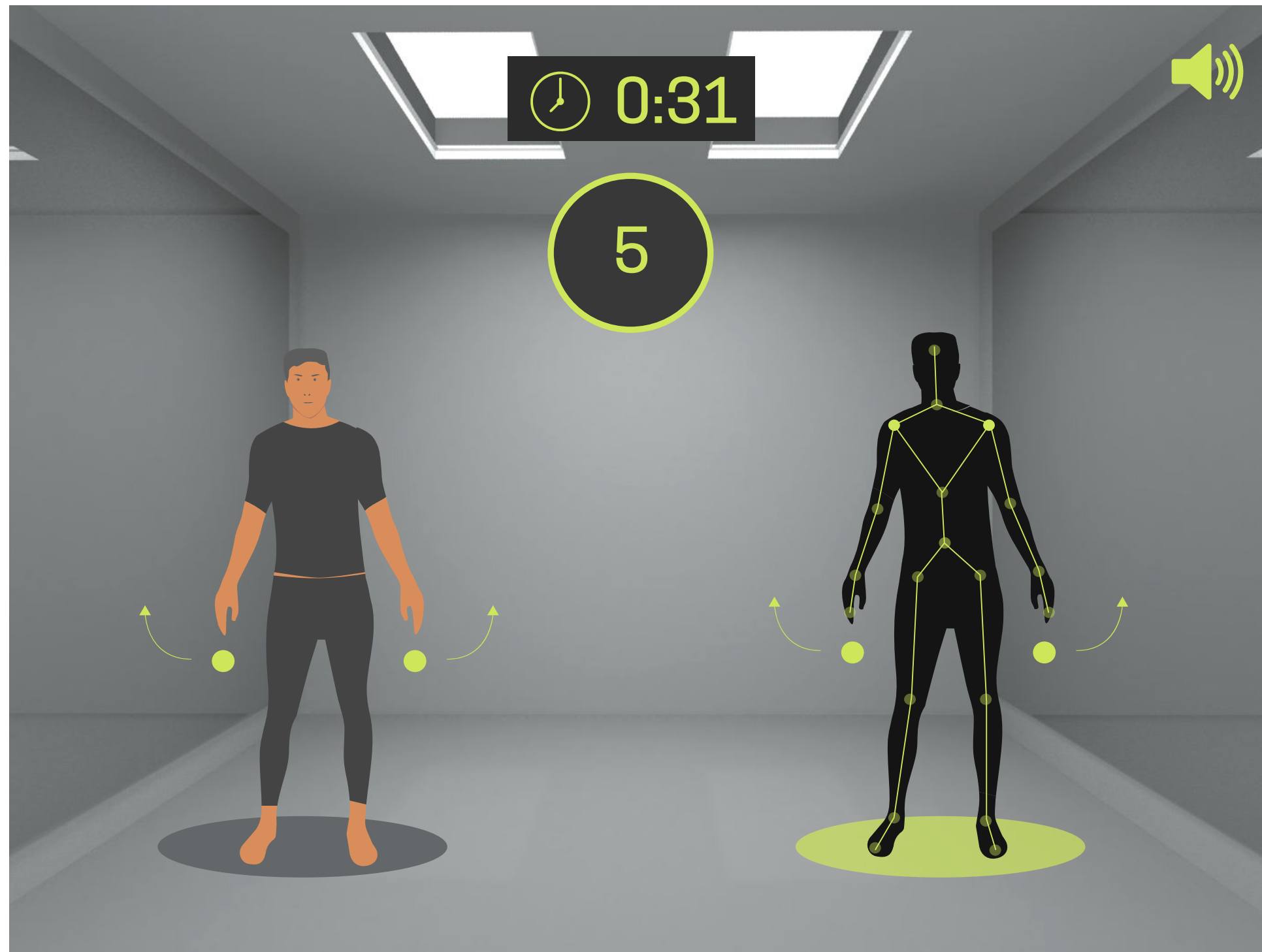


Recap

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.

Game :

- ShapeUp does not look like a game.
- Details of levels missing.
- 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 :

- 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.

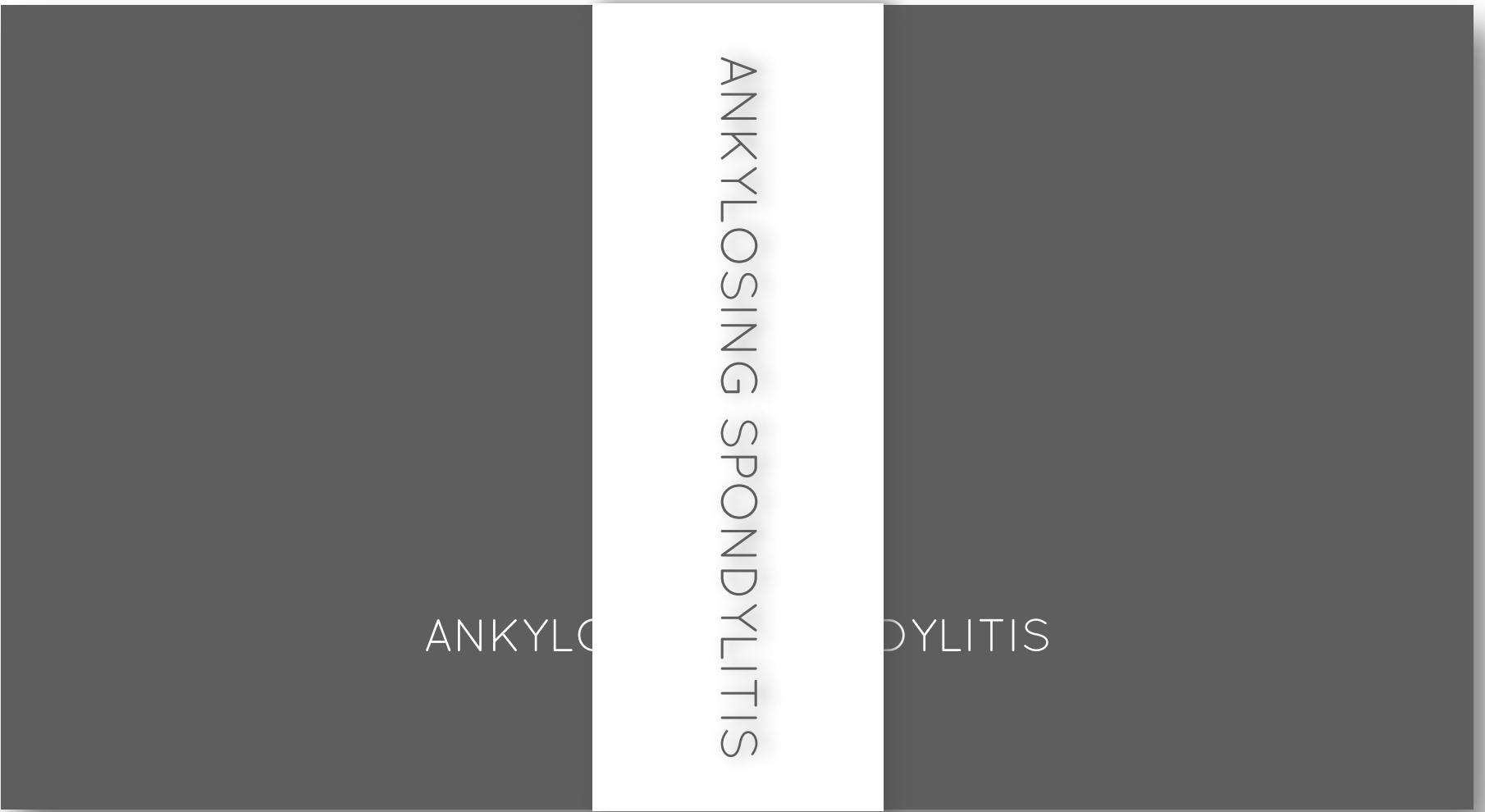


Inspiration : Most affected joint - Axial Skeleton

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.

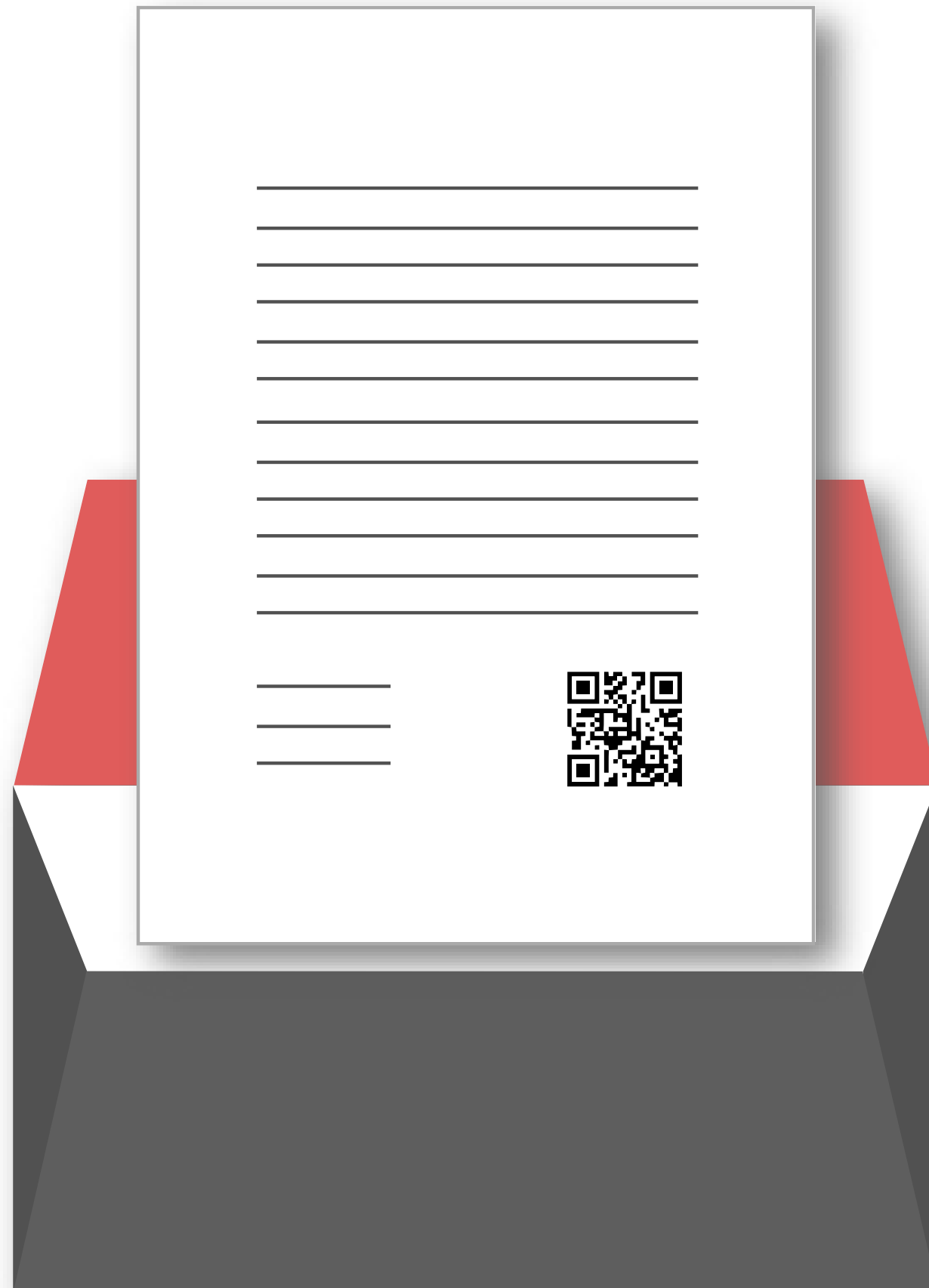


It starts with an envelope.



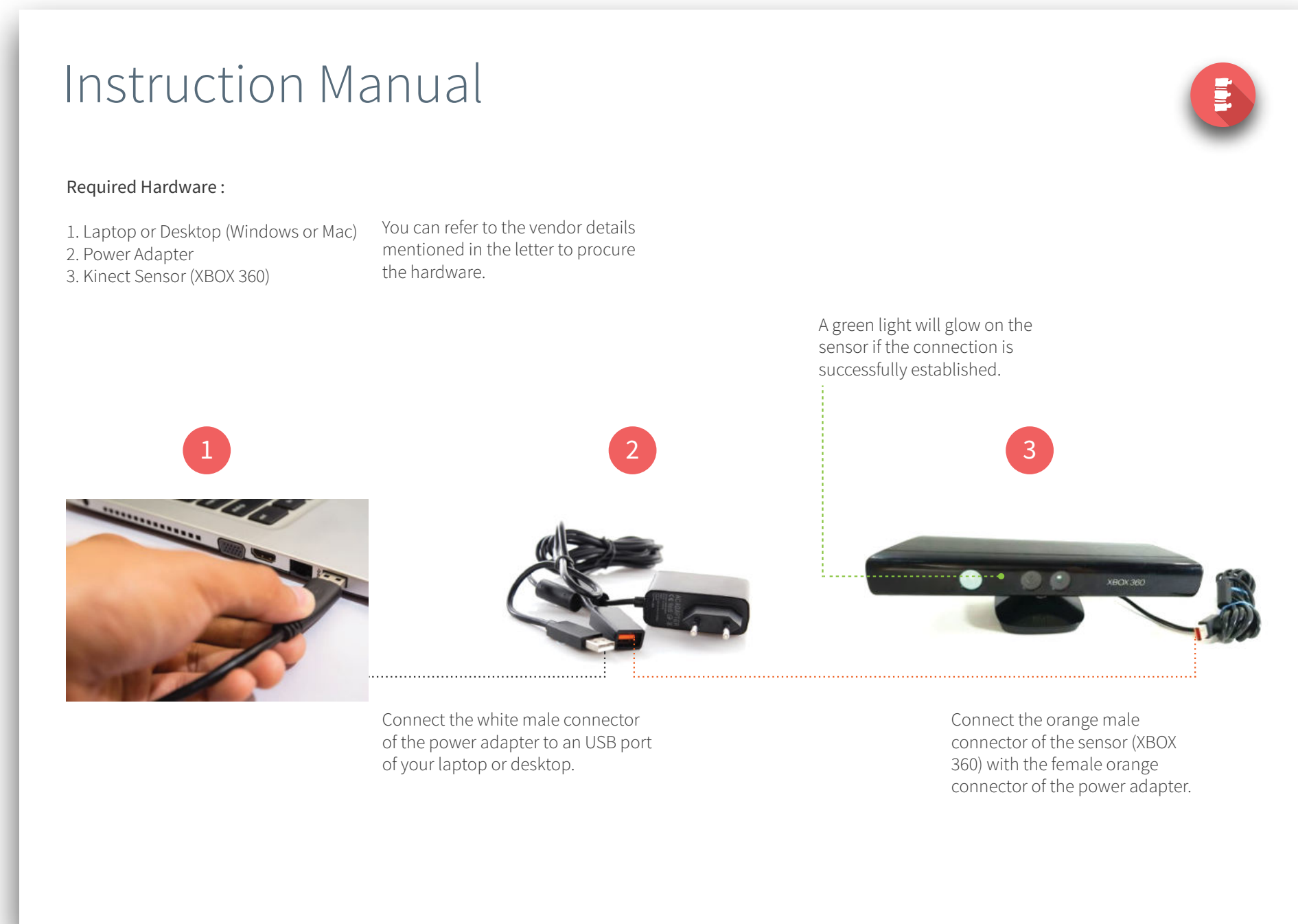
Doctors hand over the envelope to newly diagnosed patients.

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



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.



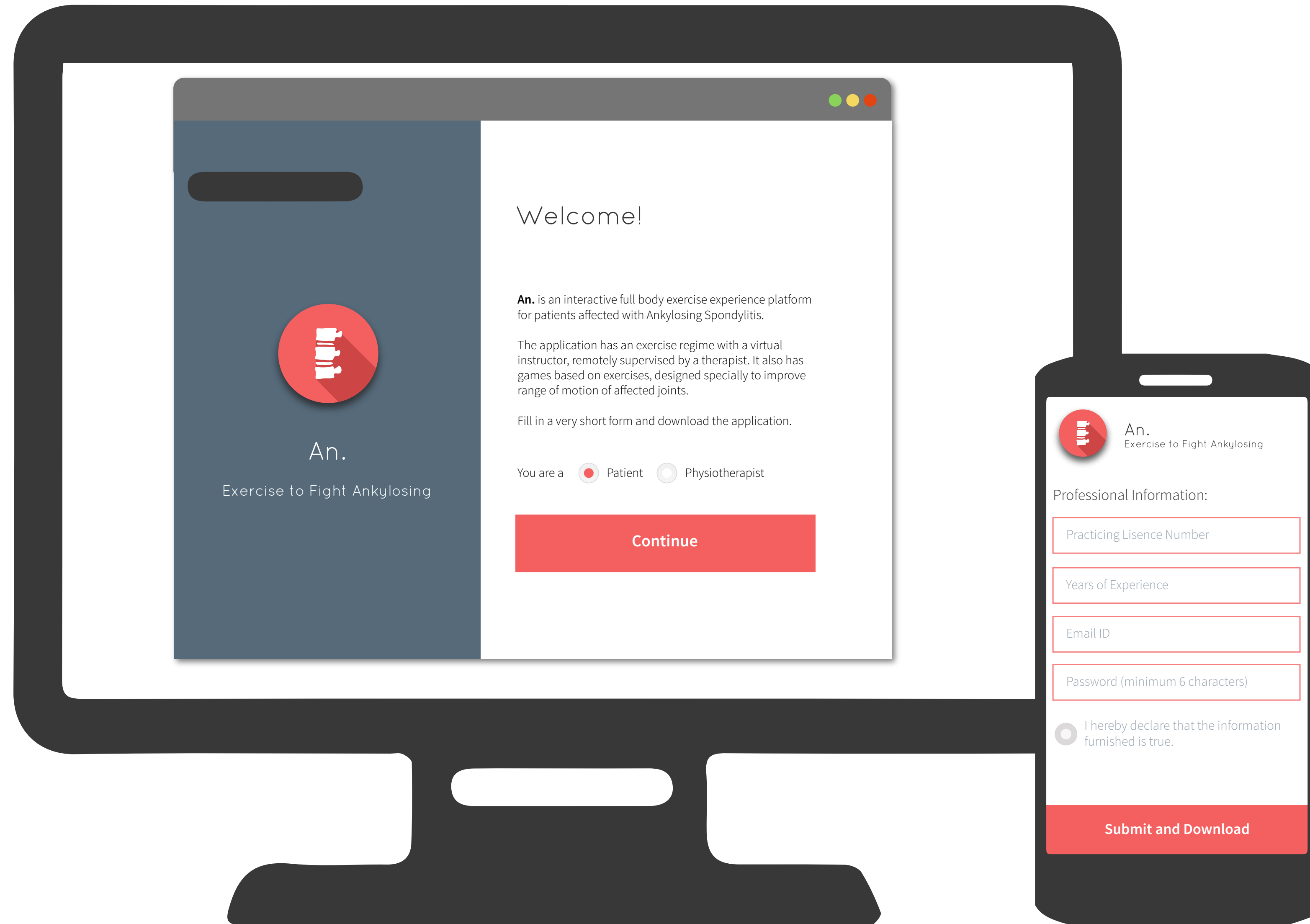
Instruction Manual

- Connecting hardware and laptop.



Badge

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



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

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



An.

Exercise to Fight Ankylosing

Welcome!

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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.

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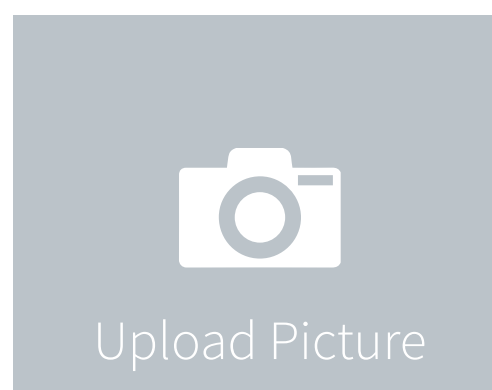
Continue



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.



Disease Information:



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:



Professional Information:



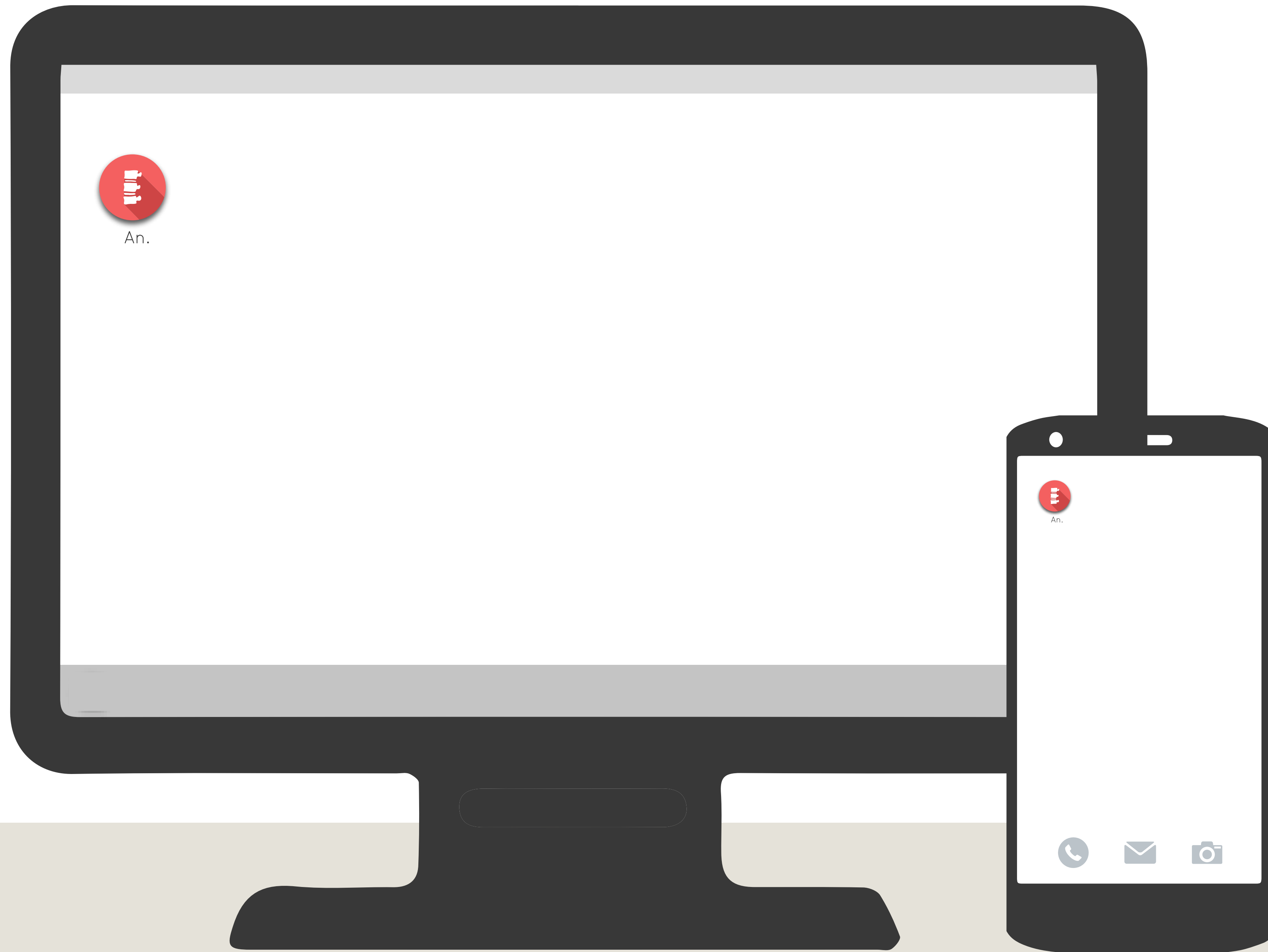
I hereby declare that the information
furnished is true.

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.

Admin
(System + Therapist)

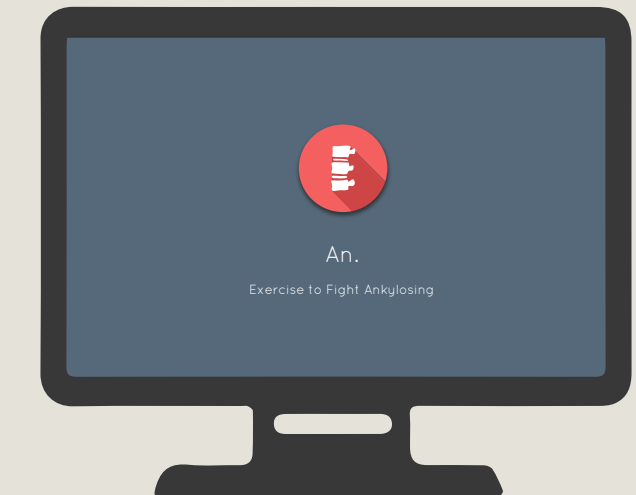
Therapist Admin

- Content generation.
- Auto mode algorithm improvisation.



Therapists

Patients

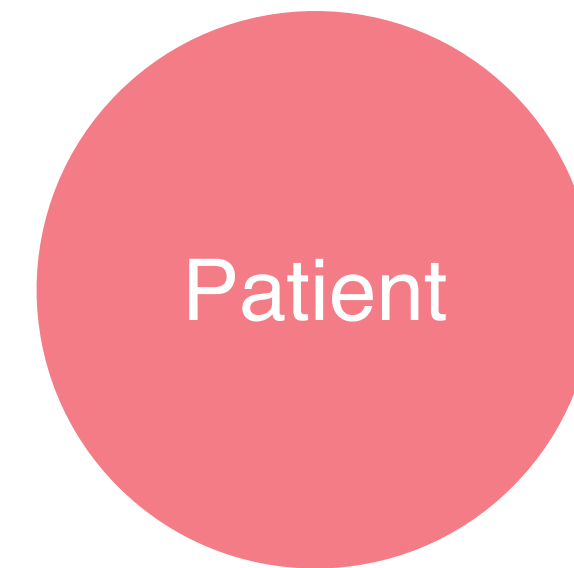
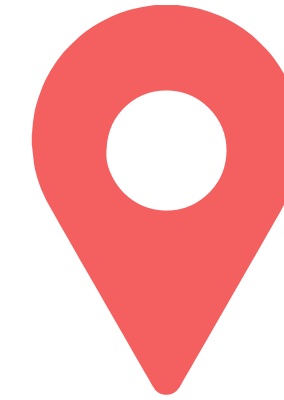


Mapping of therapist and patients - Auto location based mapping

Vashi



Kamothe



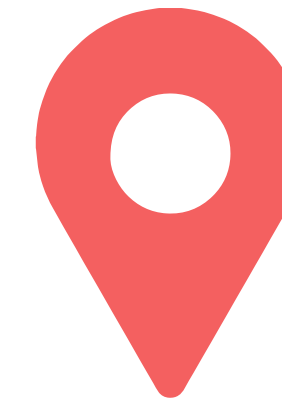
Vashi



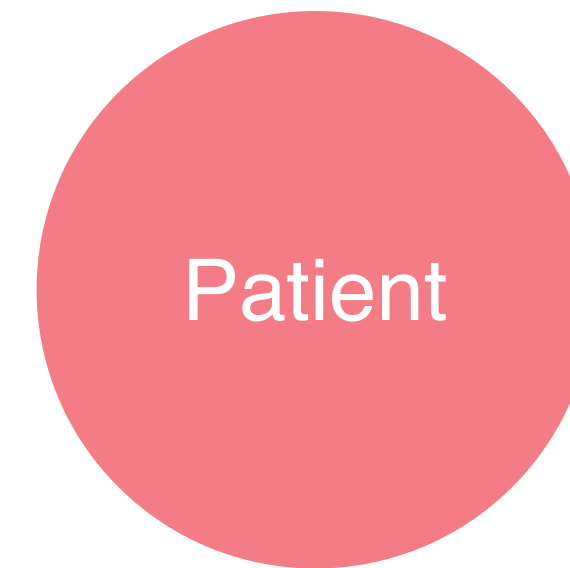
Therapist



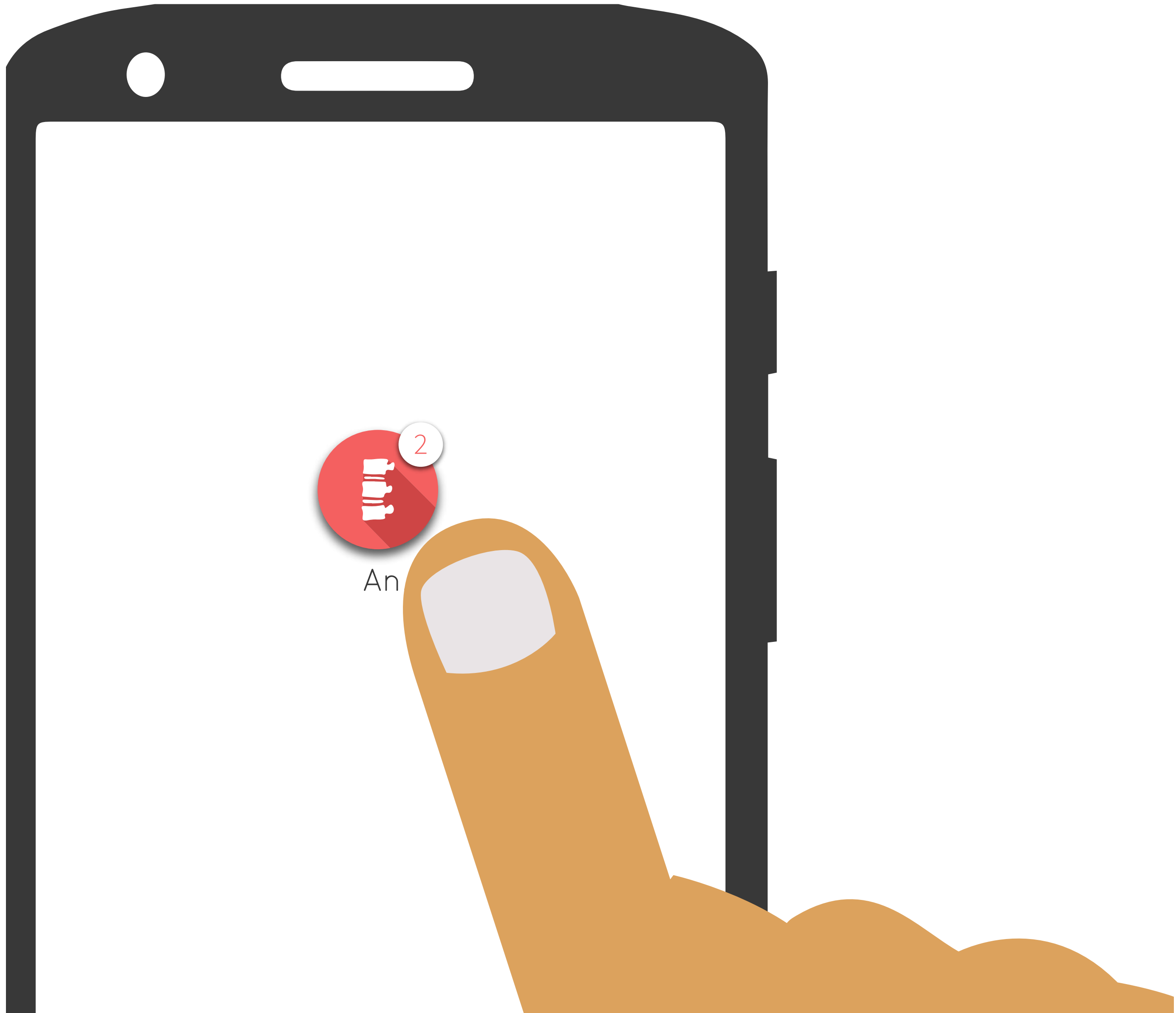
Kamothe



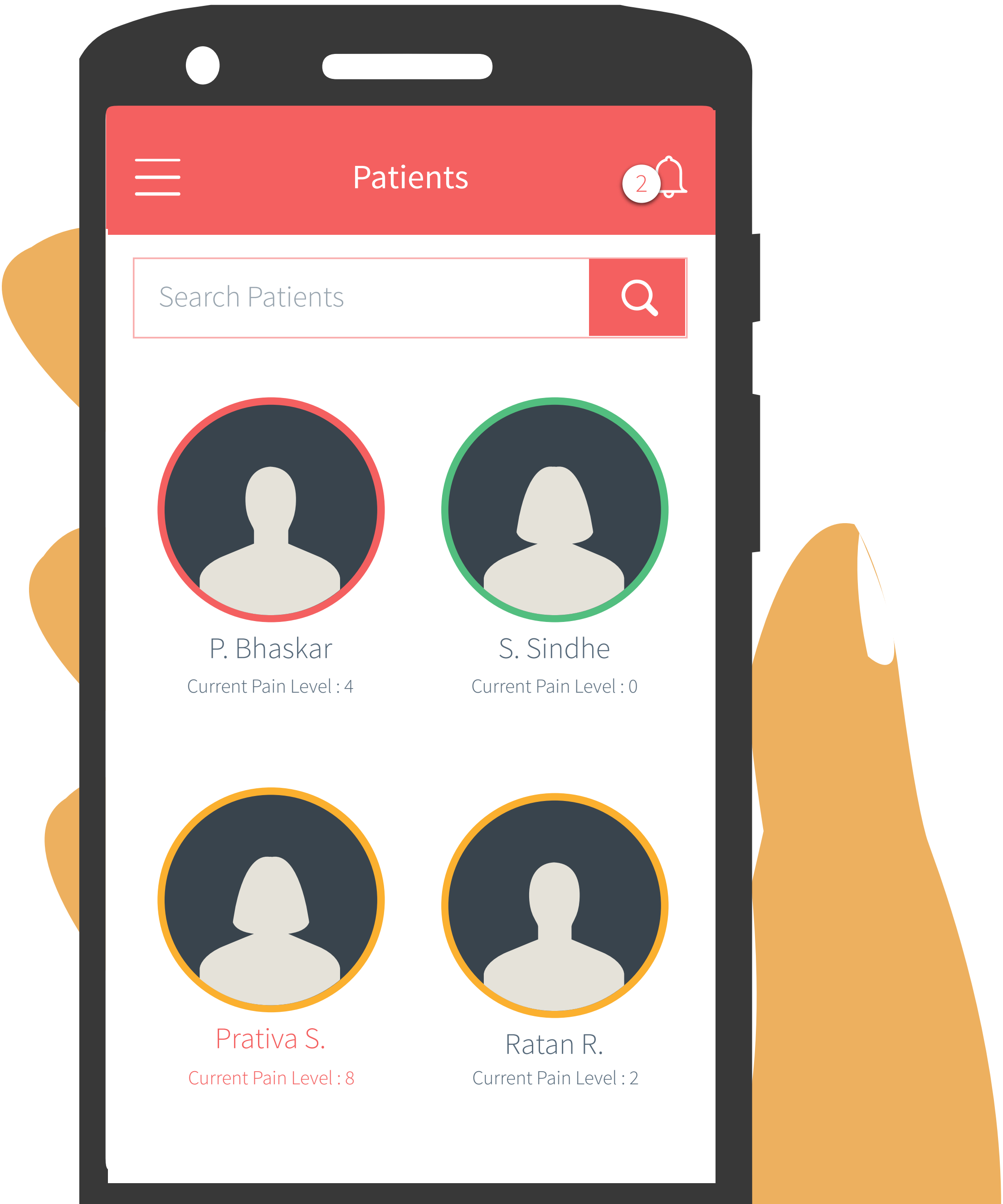
Patient



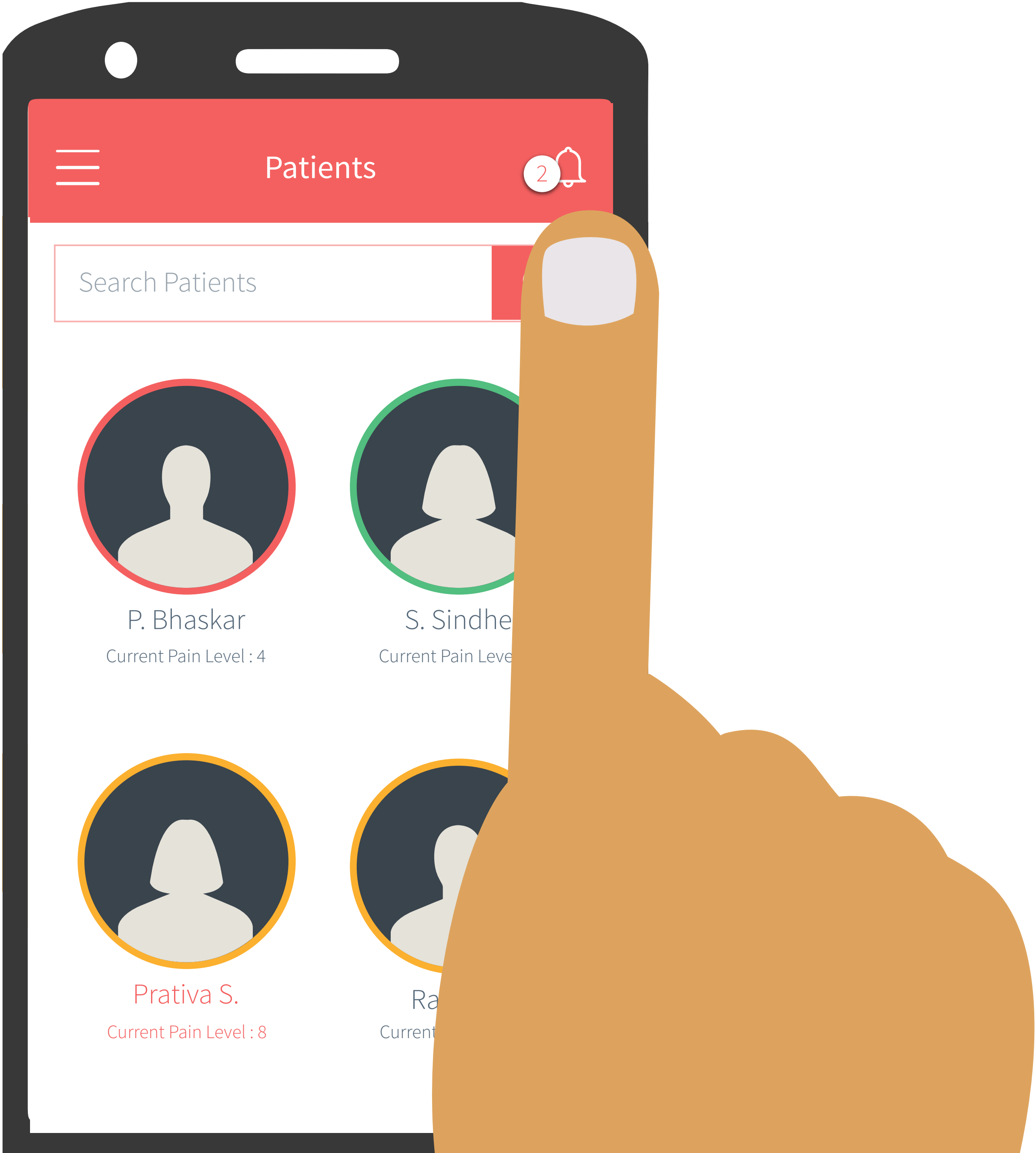
Physiotherapist



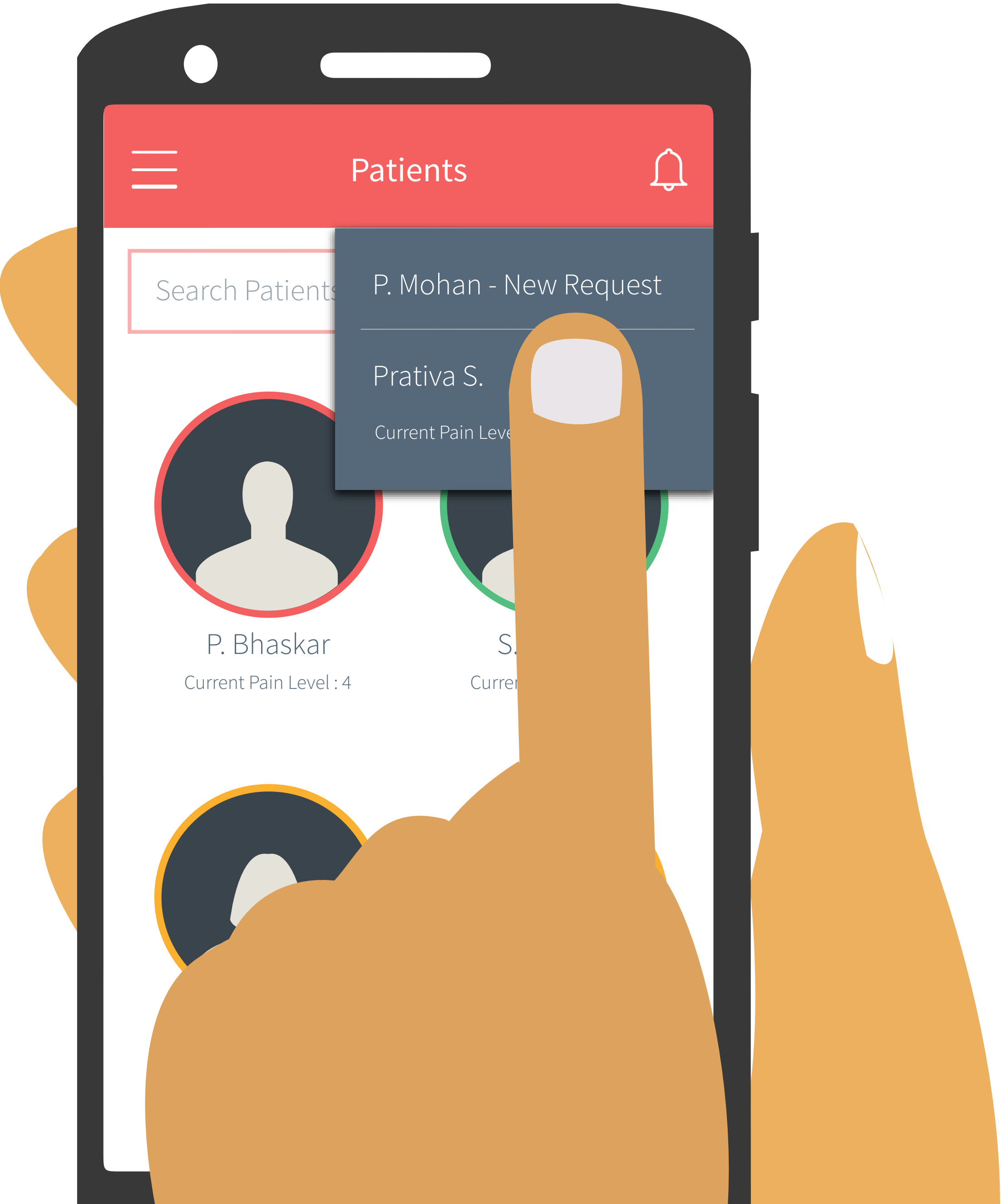
Physiotherapist



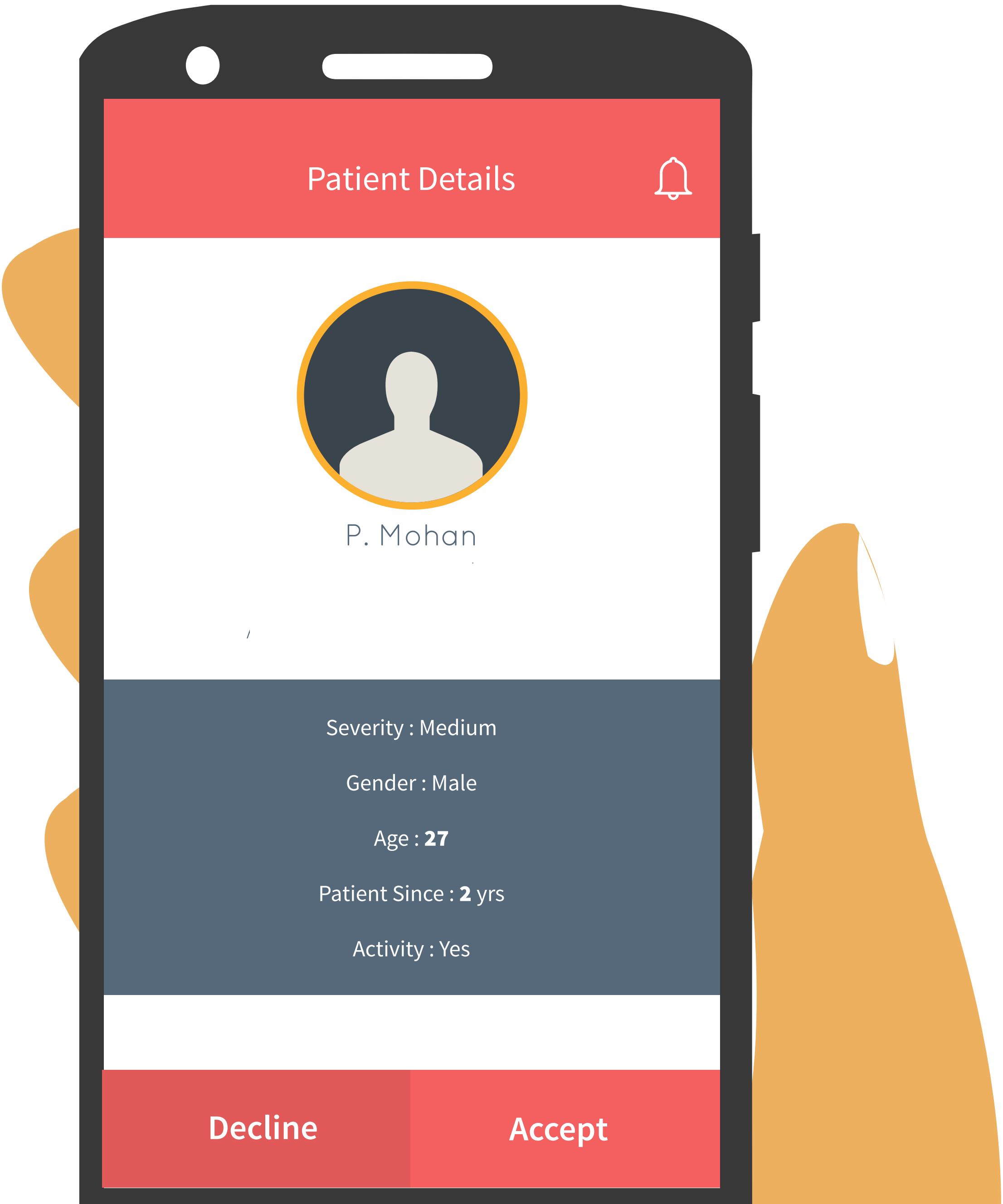
Physiotherapist



Physiotherapist



Physiotherapist



P. Mohan

Physiotherapist

Severity : Medium

Gender : Male

Age : **27**

Patient Since : **2** yrs

Activity : Yes

Decline

Accept

Physiotherapist

<

Patient Details

P. Mohan

Severity : Medium

Gender : Male

Age : **27**

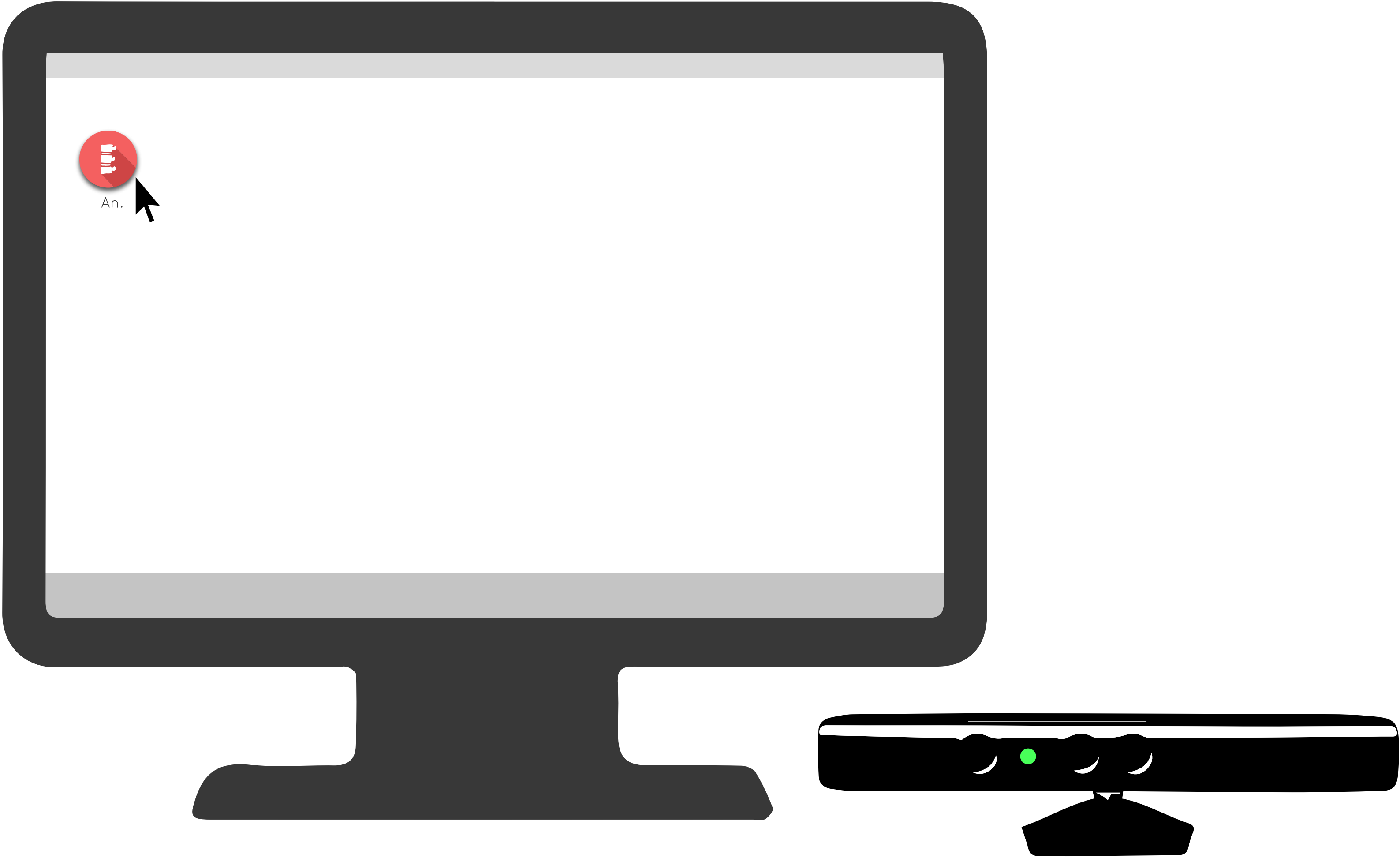
Patient Since : **2** yrs

Activity : Yes

Exercises

Report

1st time patient





An.





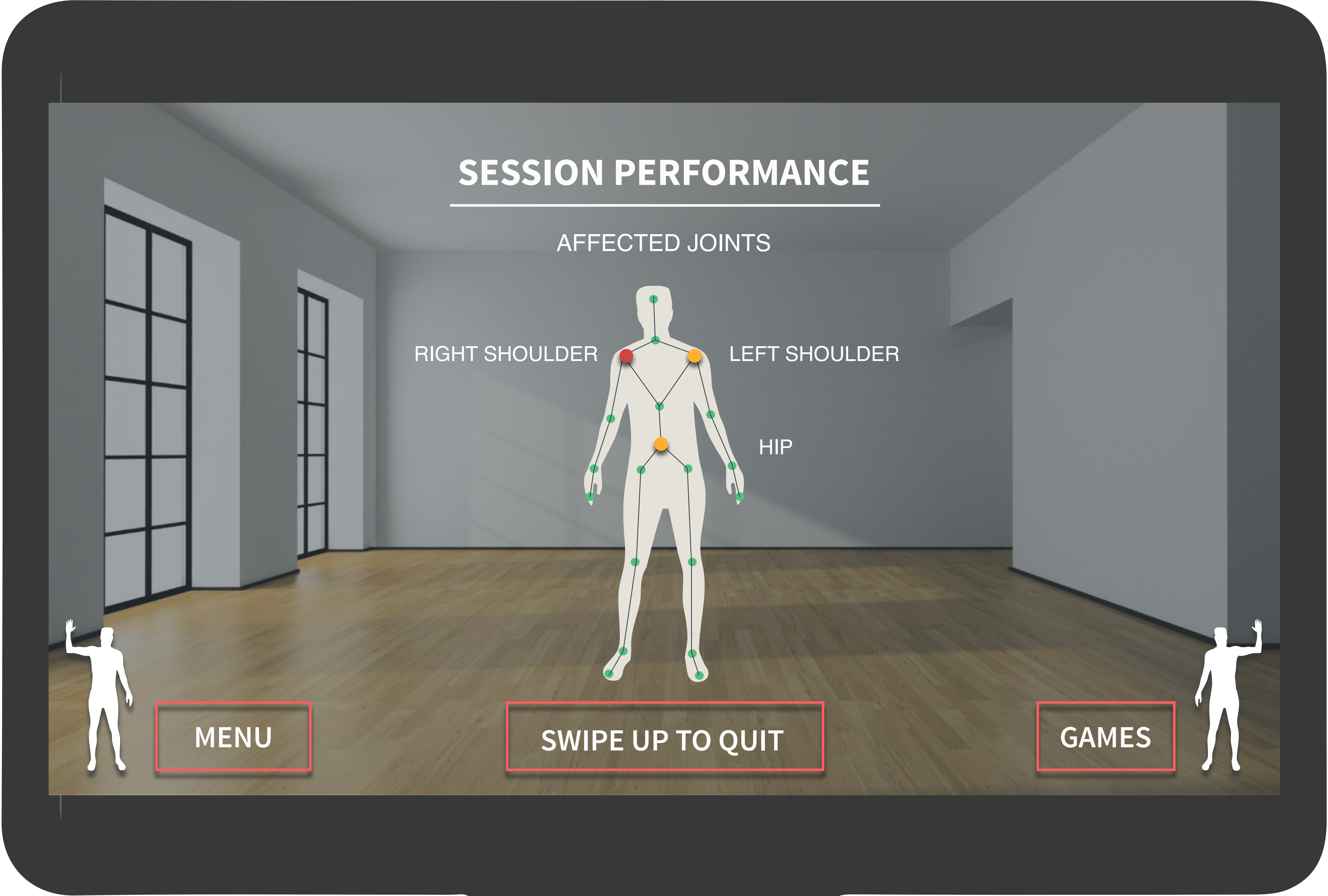
Calibration Session



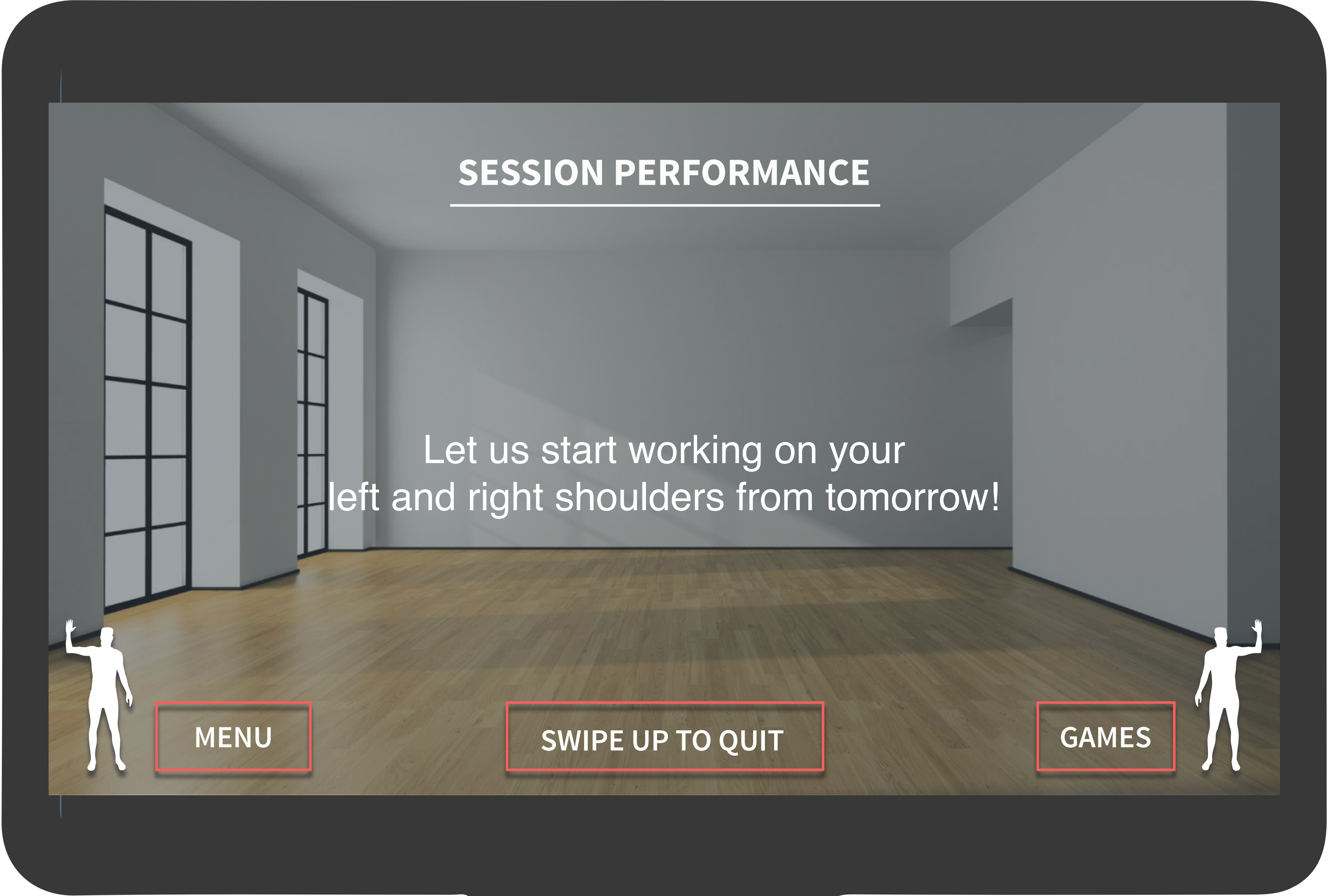
Calibration Session



Calibration Session



Calibration Session



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**

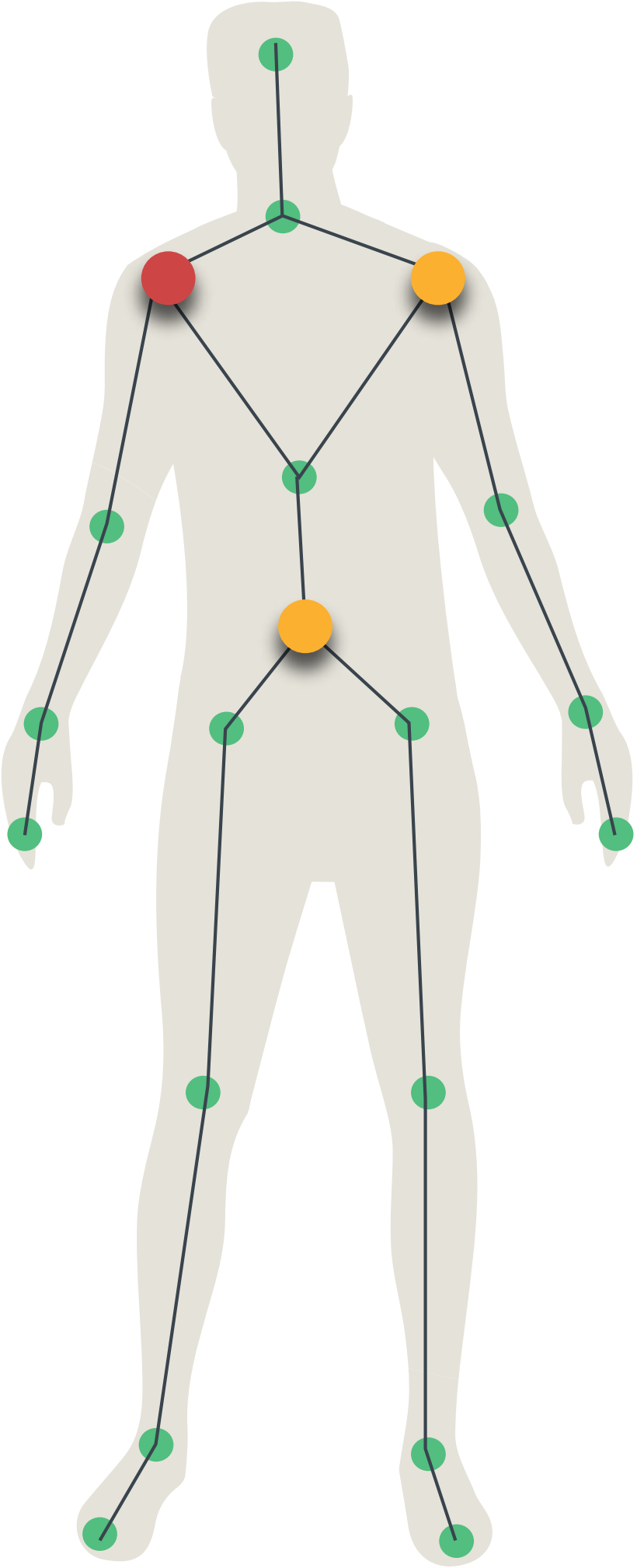
Patient Since : **2** yrs

Activity : Yes

Exercises

Report

Physiotherapist

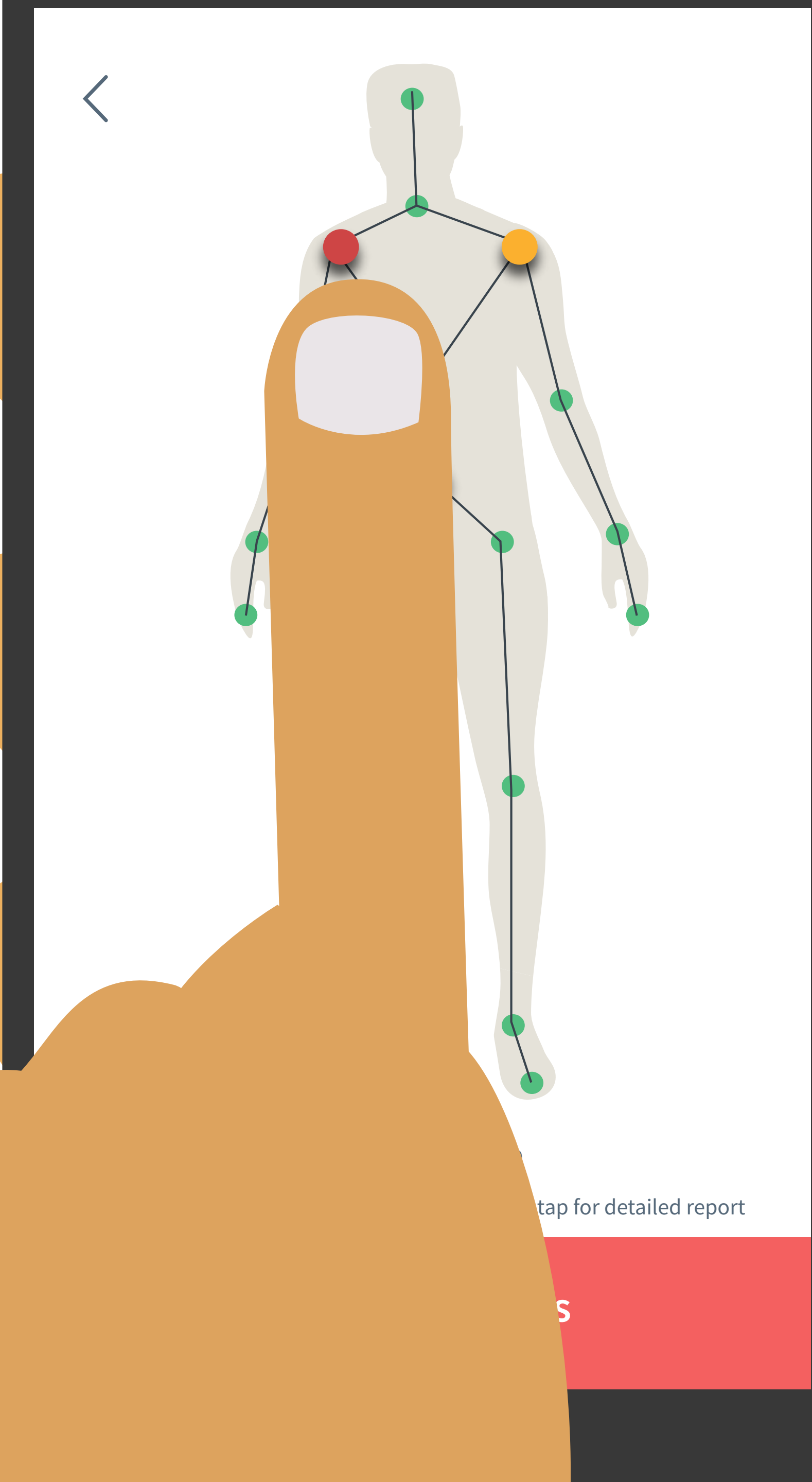


Current Pain Level : 0

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

Assign Exercises

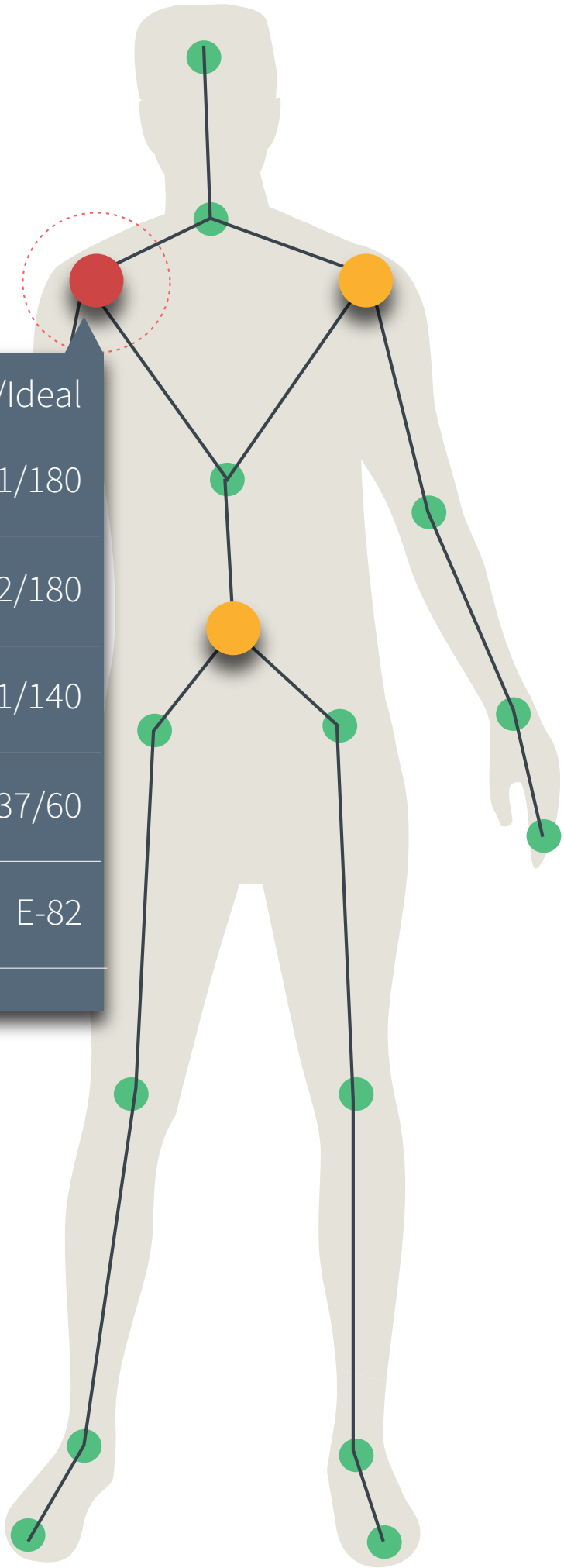
Physiotherapist



Physiotherapist



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

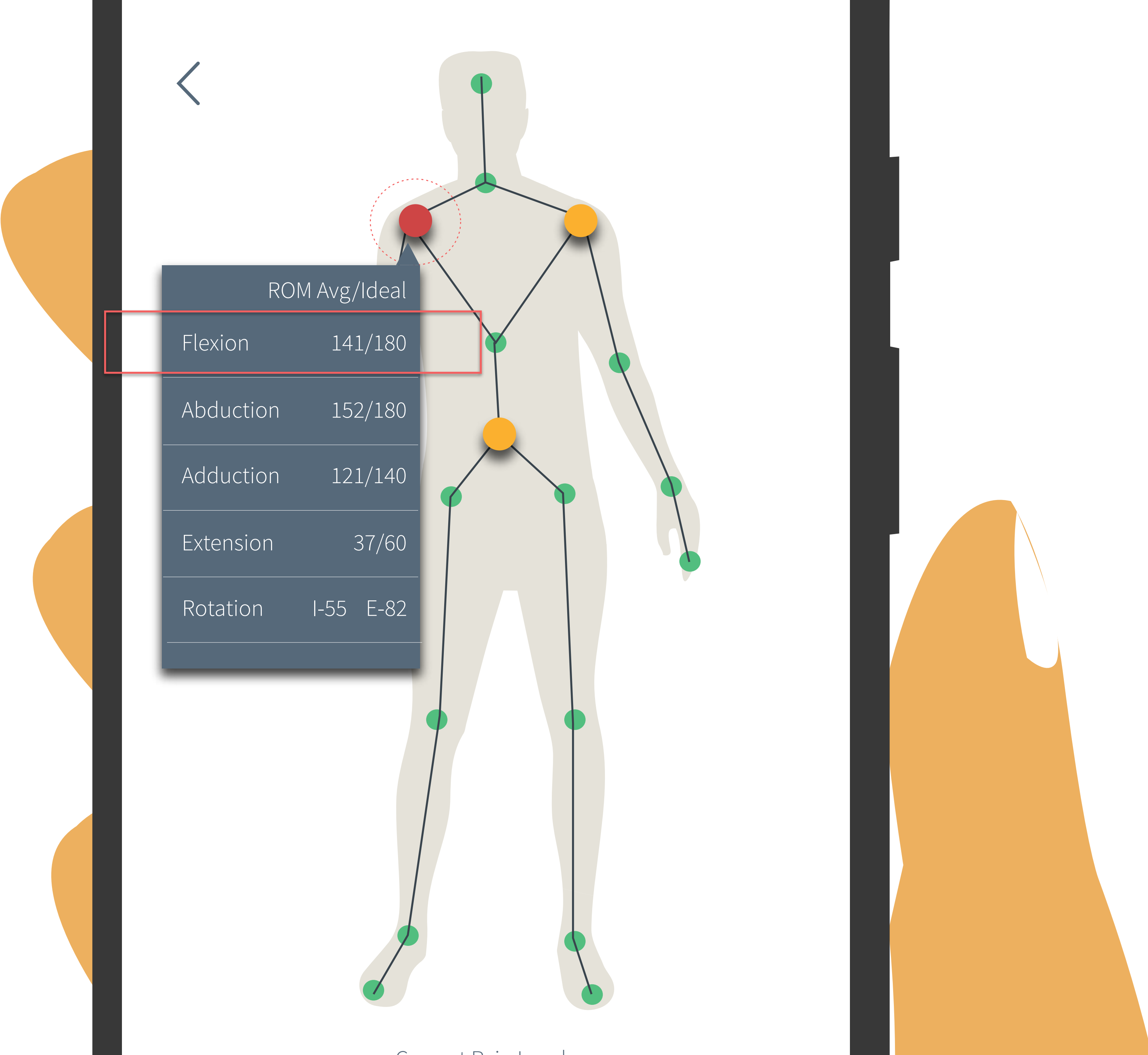


Current Pain Level :

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

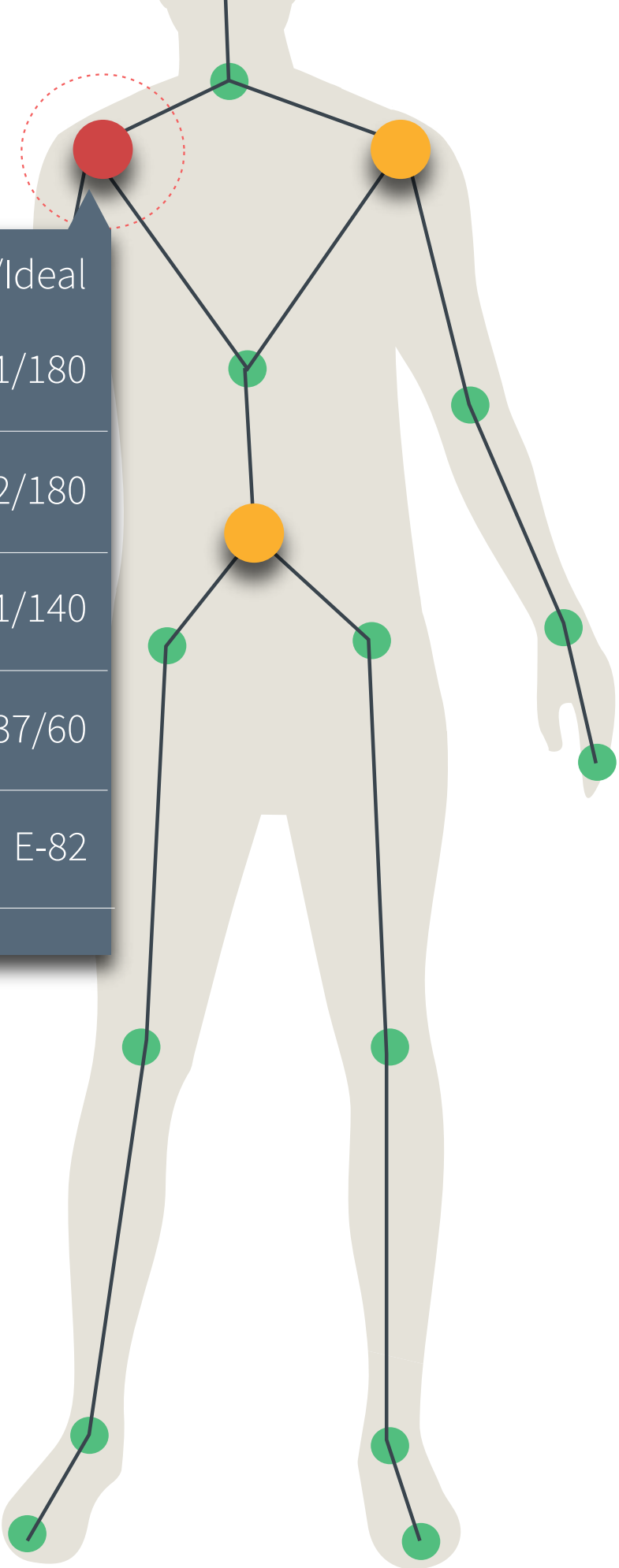
Assign Exercises

Physiotherapist



Physiotherapist

ROM Avg/Ideal		
Flexion	141/180	
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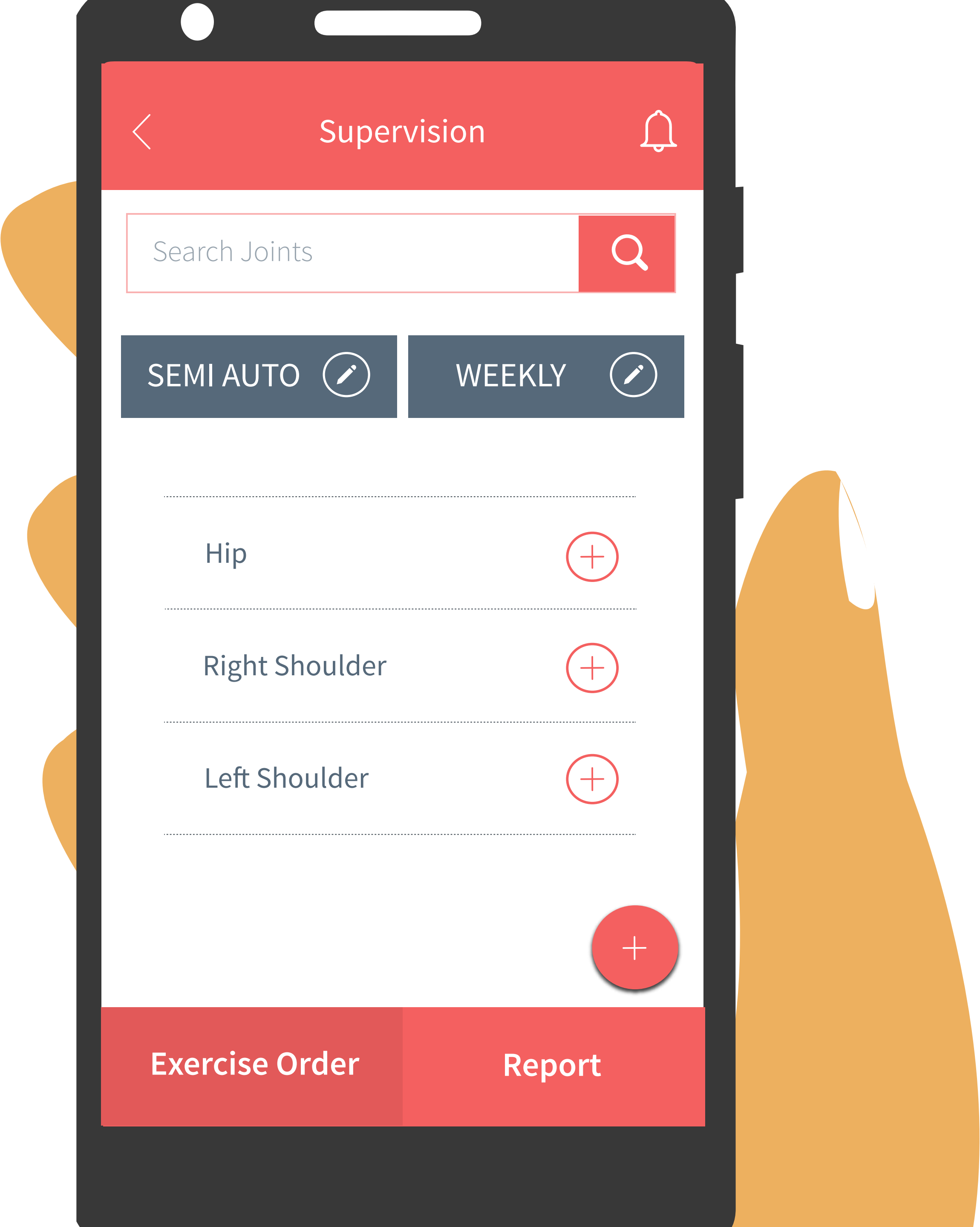


Current Pain Level :

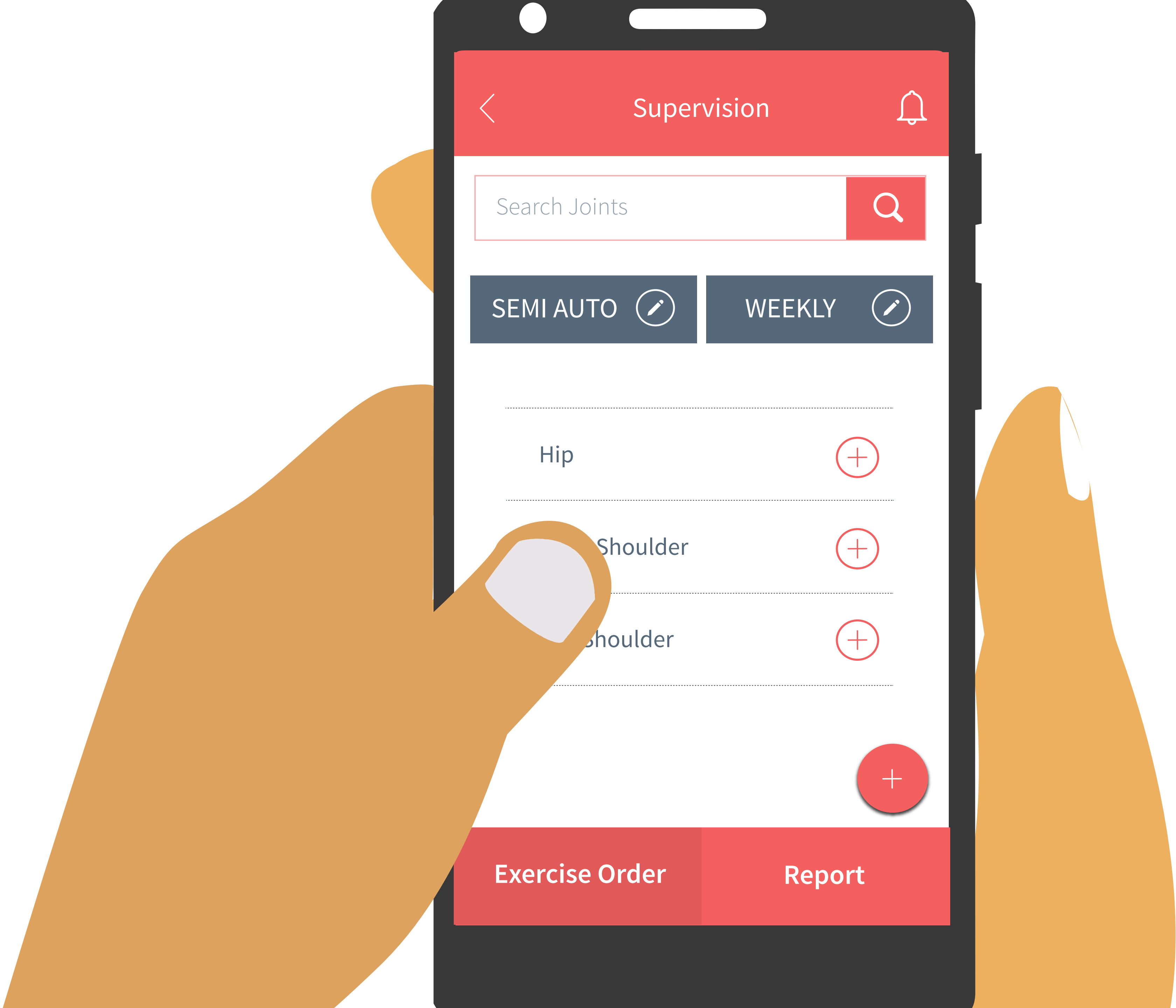
Tap on each joint to view quick report, double tap for detailed report

Assign Exercises

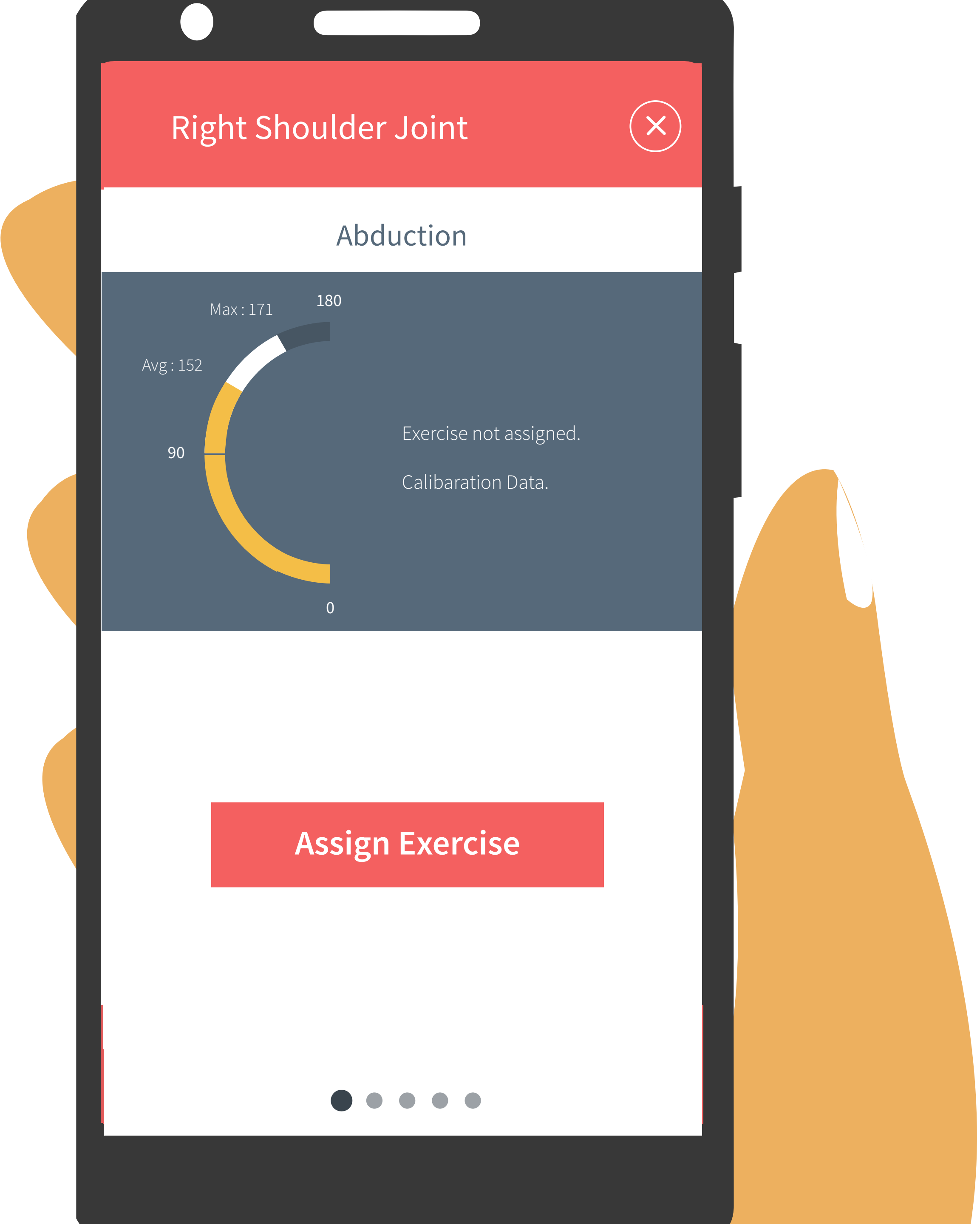
Physiotherapist



Physiotherapist

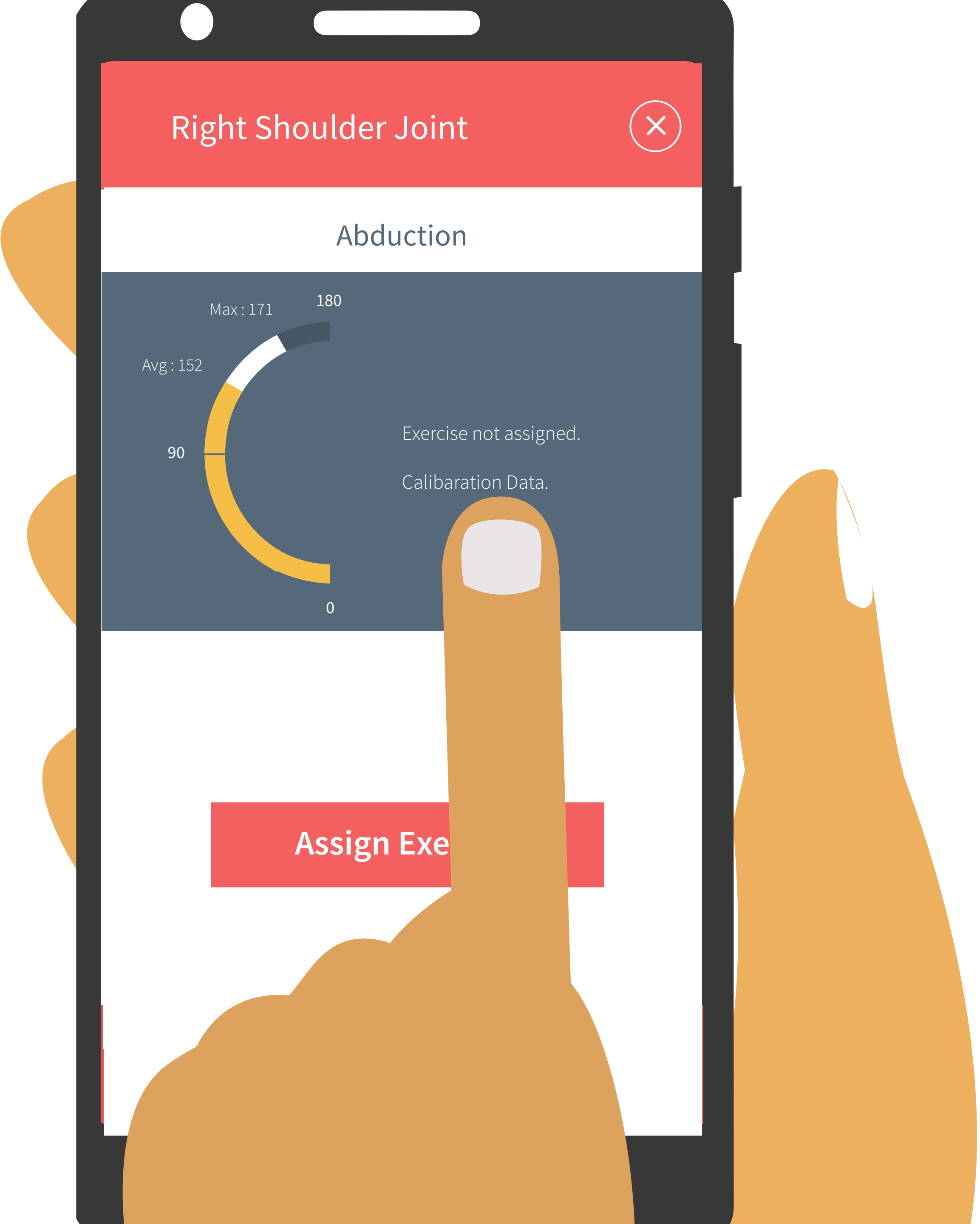


Physiotherapist

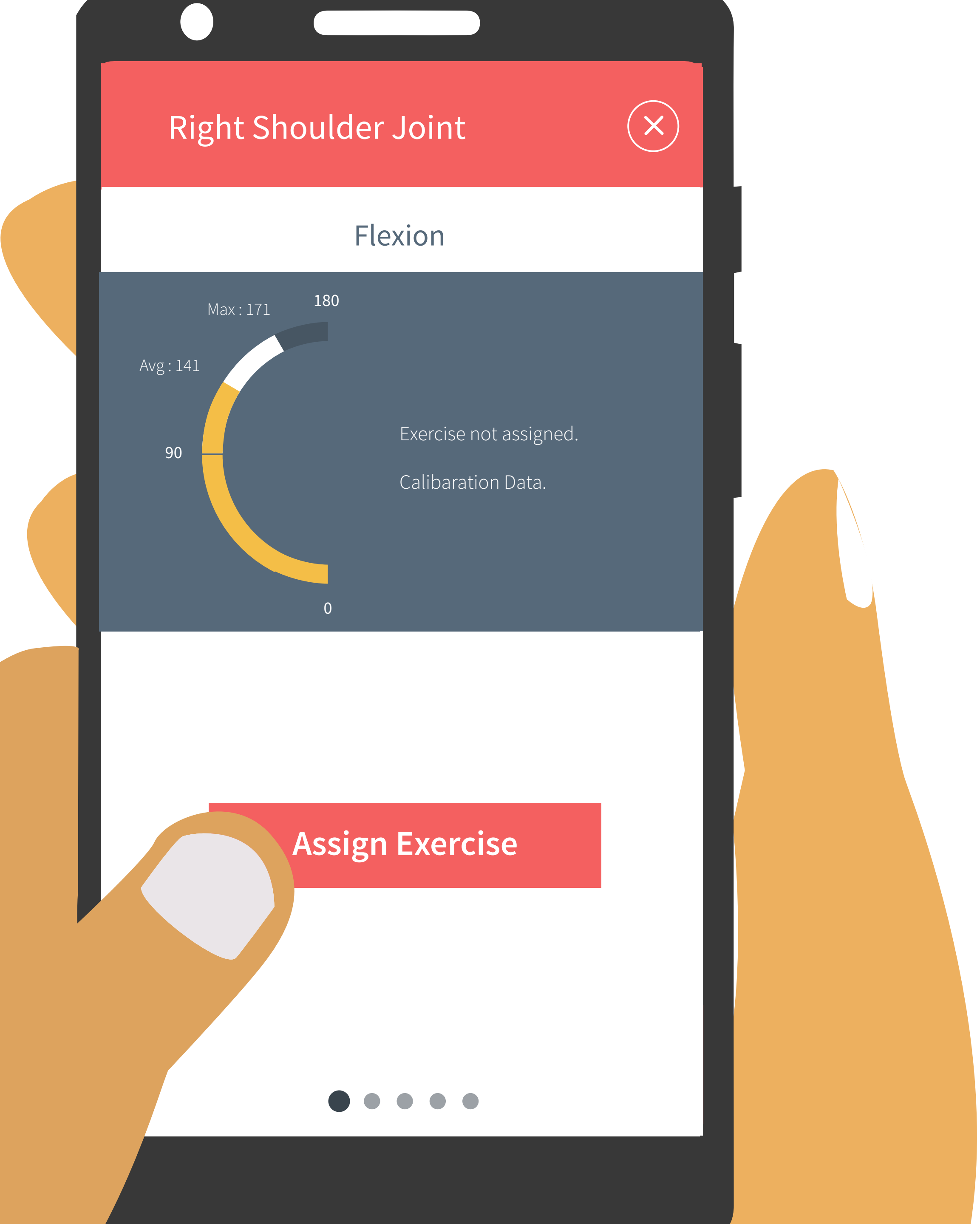


Physiotherapist

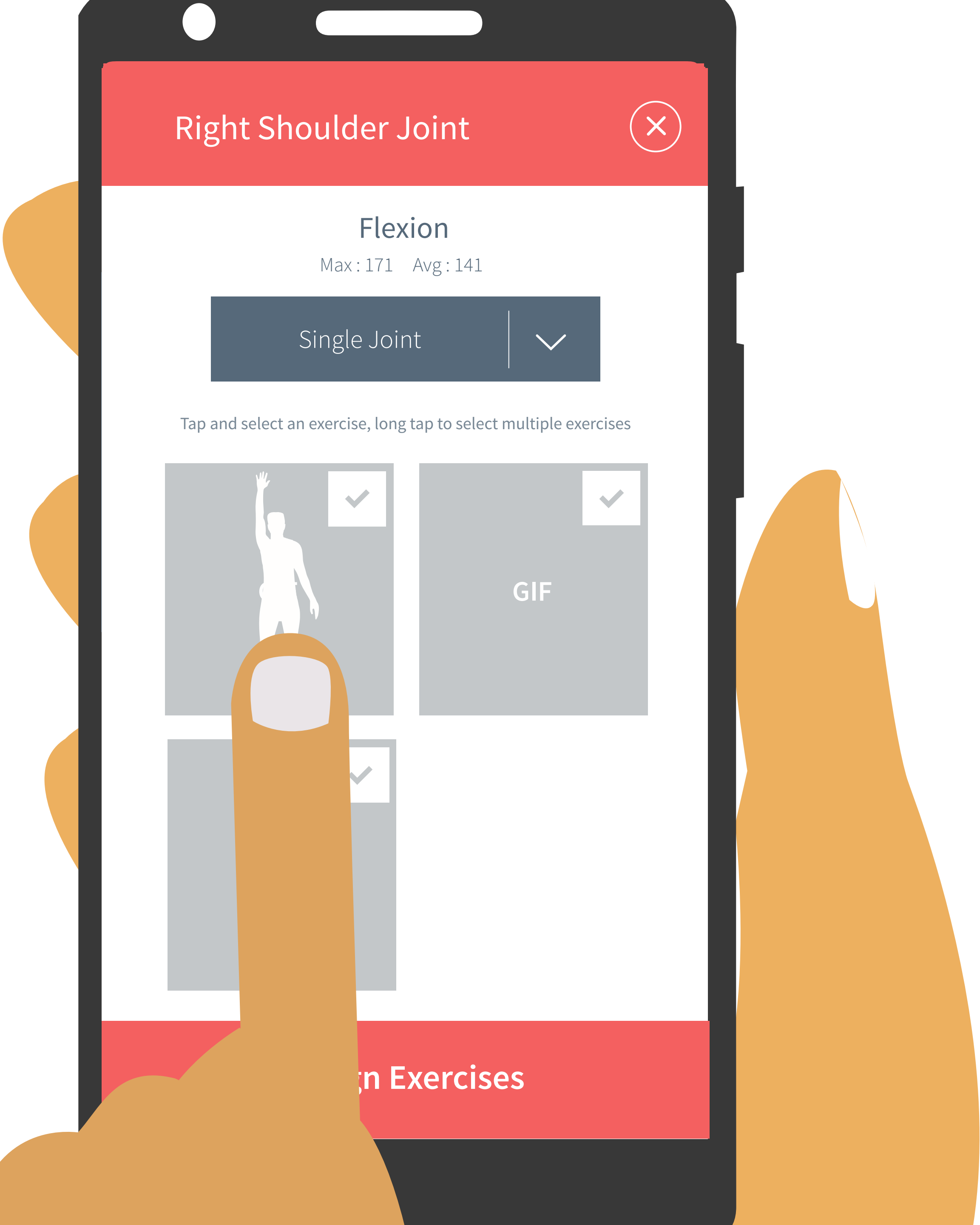
Swipe Left



Physiotherapist



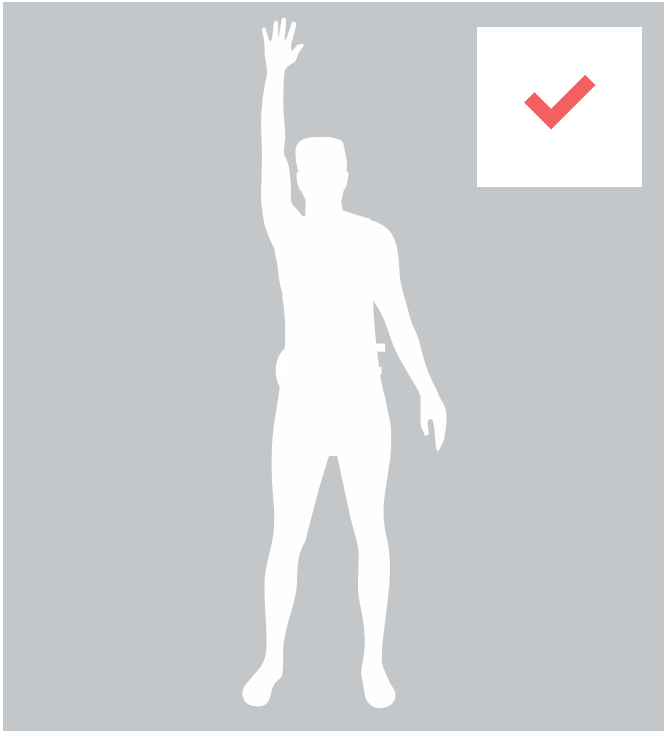
Physiotherapist




Physiotherapist

Single Joint

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




☒



☒

GIF



☒

Speed

10

20

30

40

>

Repetitions

5

10

15

20

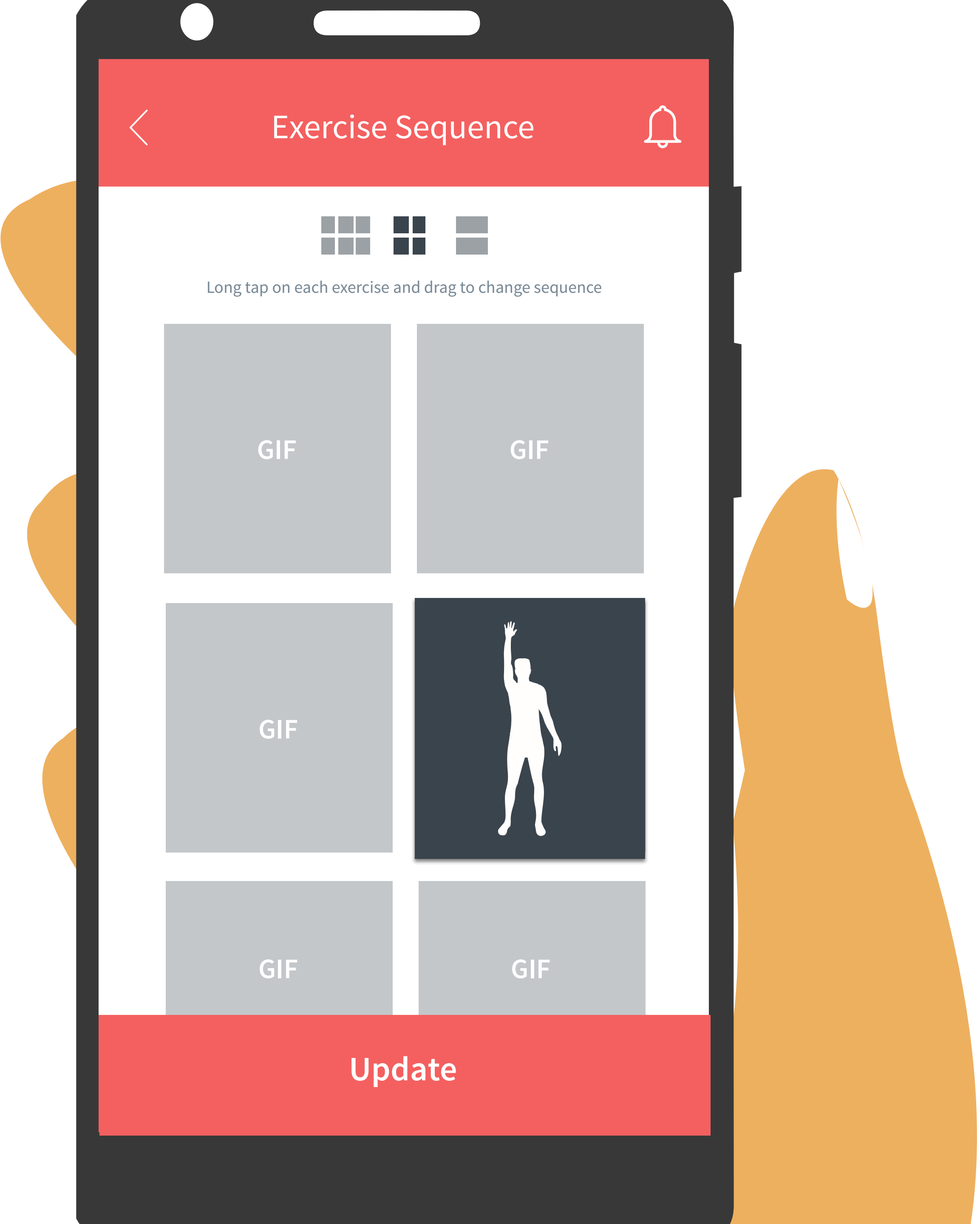
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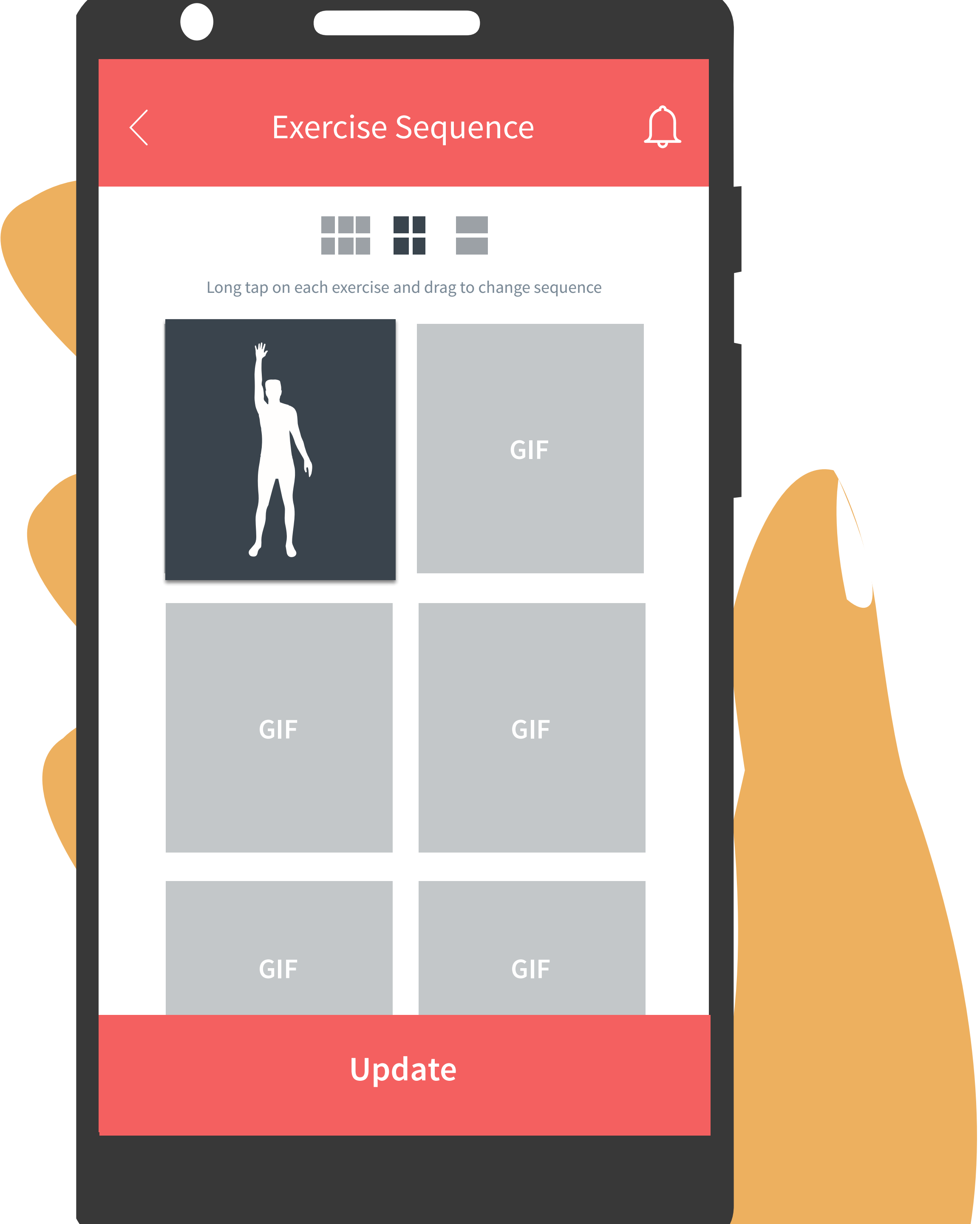
add in left shoulder

Assign Exercises

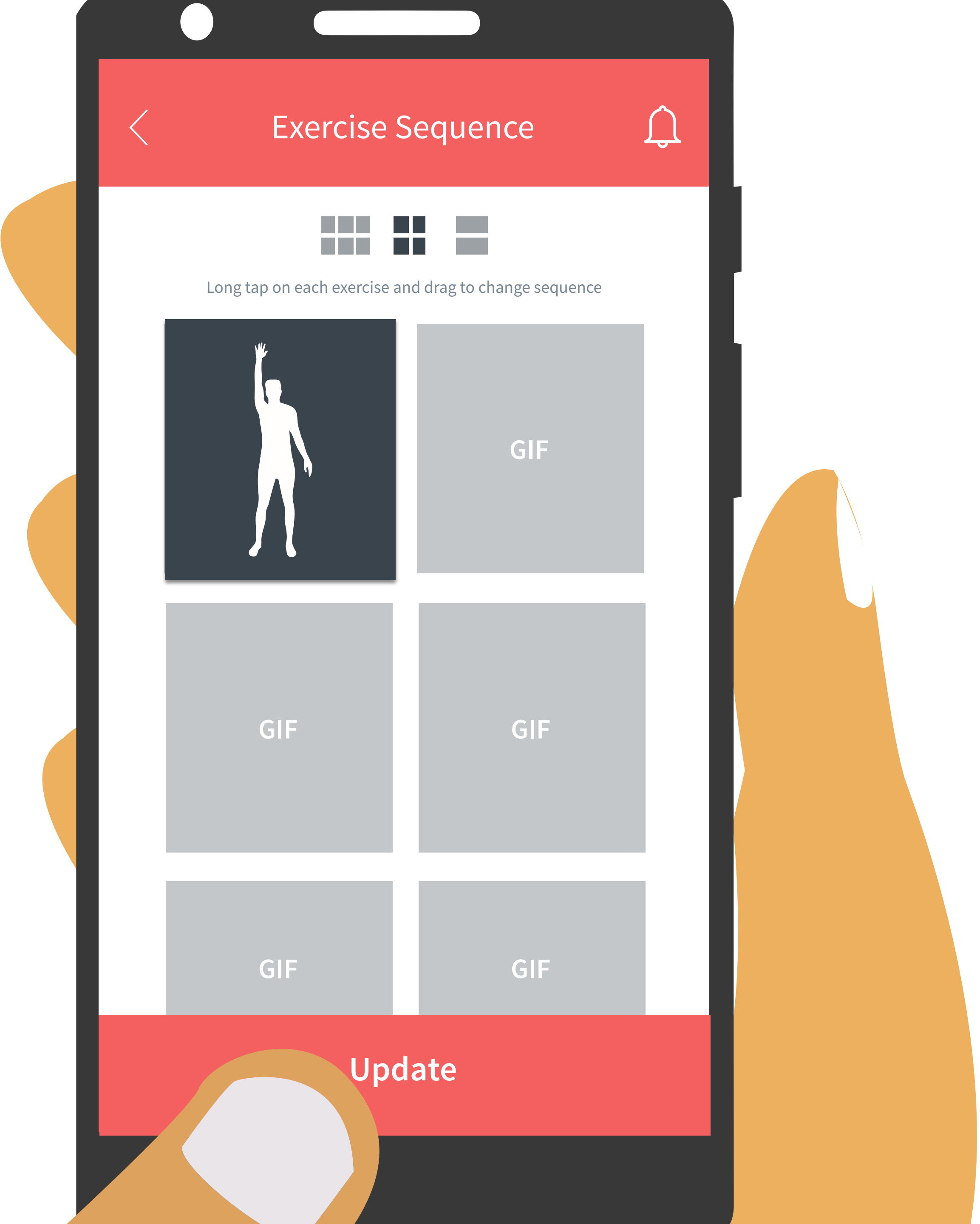
Physiotherapist



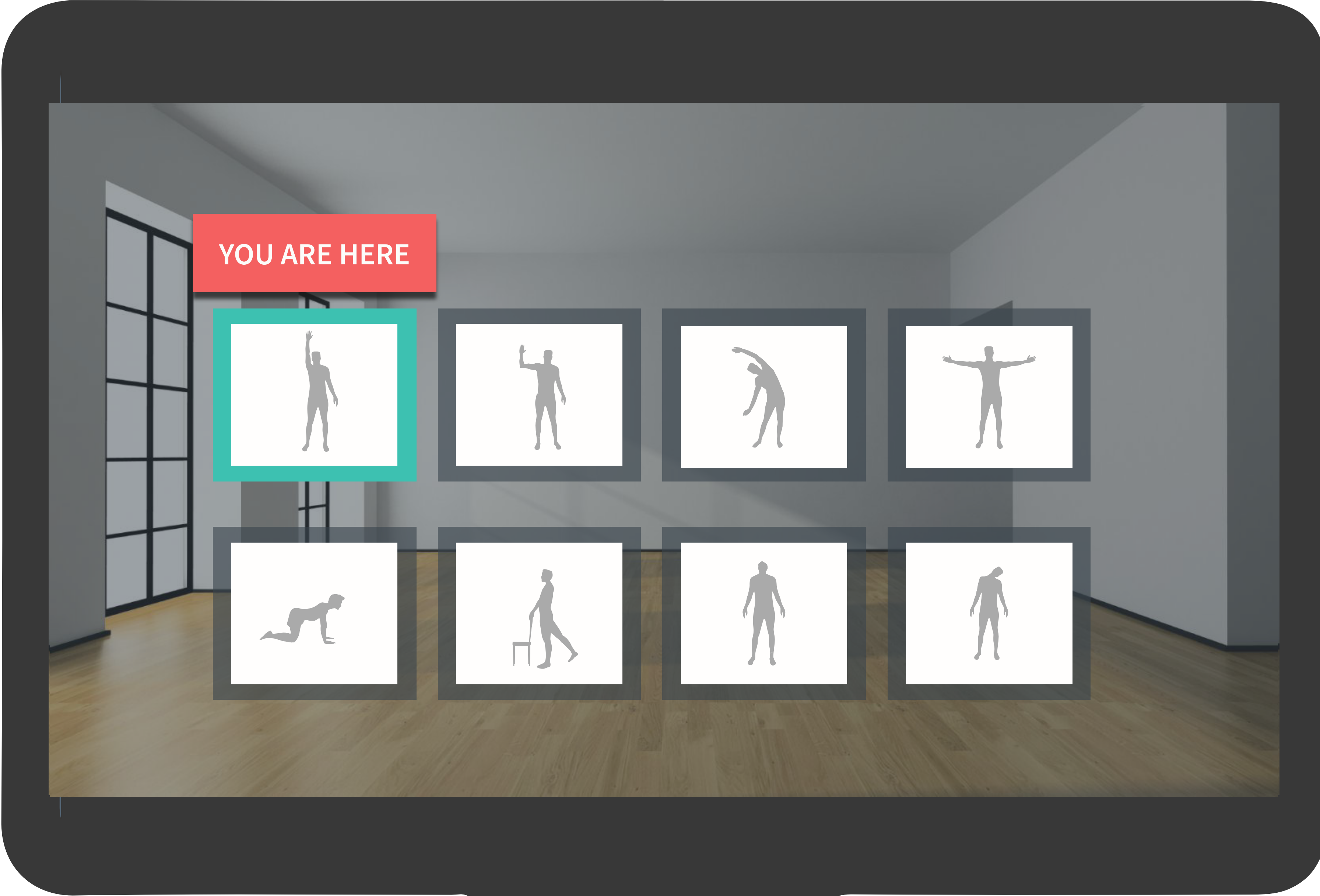
Physiotherapist



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

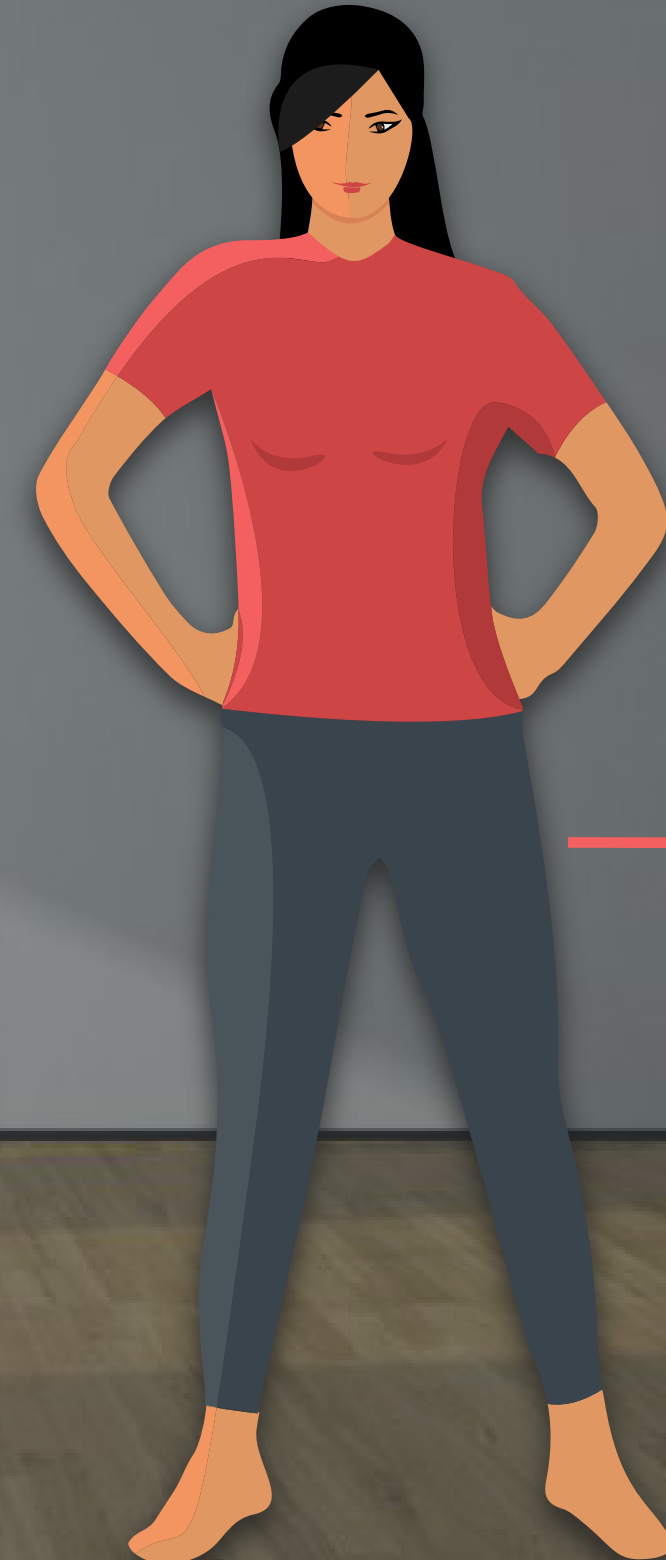


SWIPE UP TO QUIT



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

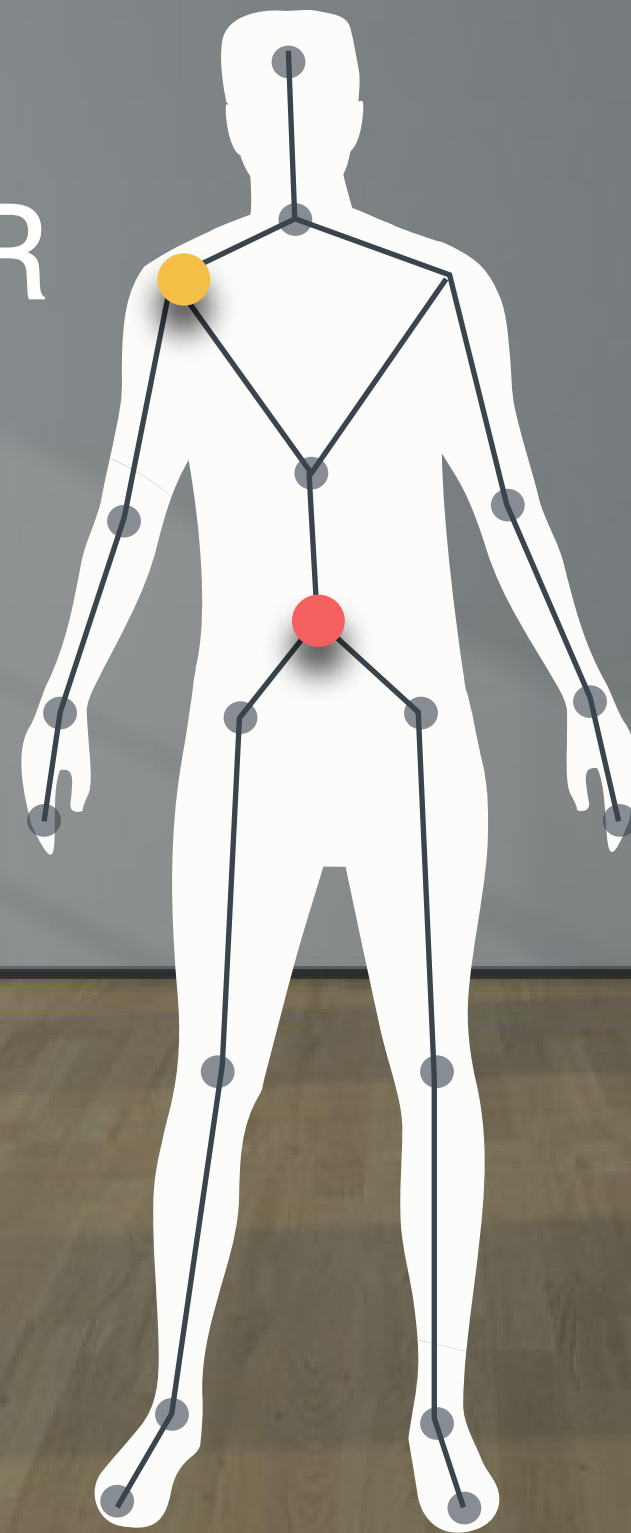


SESSION PERFORMANCE

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



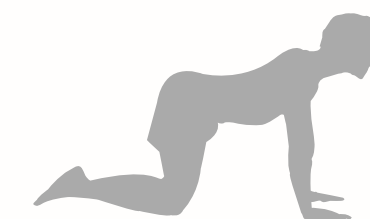
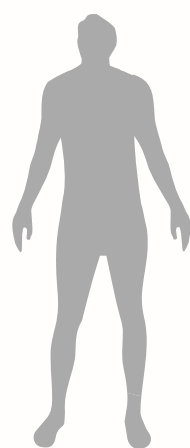
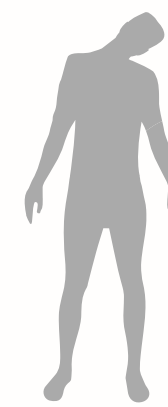
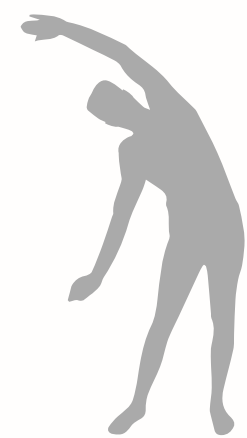
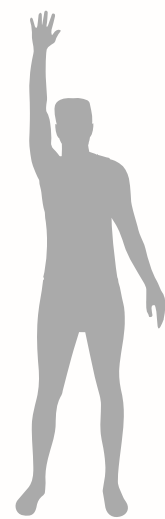
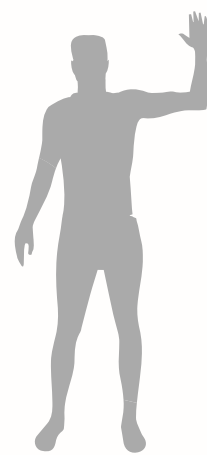
TO PLAY GAMES

RAISE RIGHT HAND



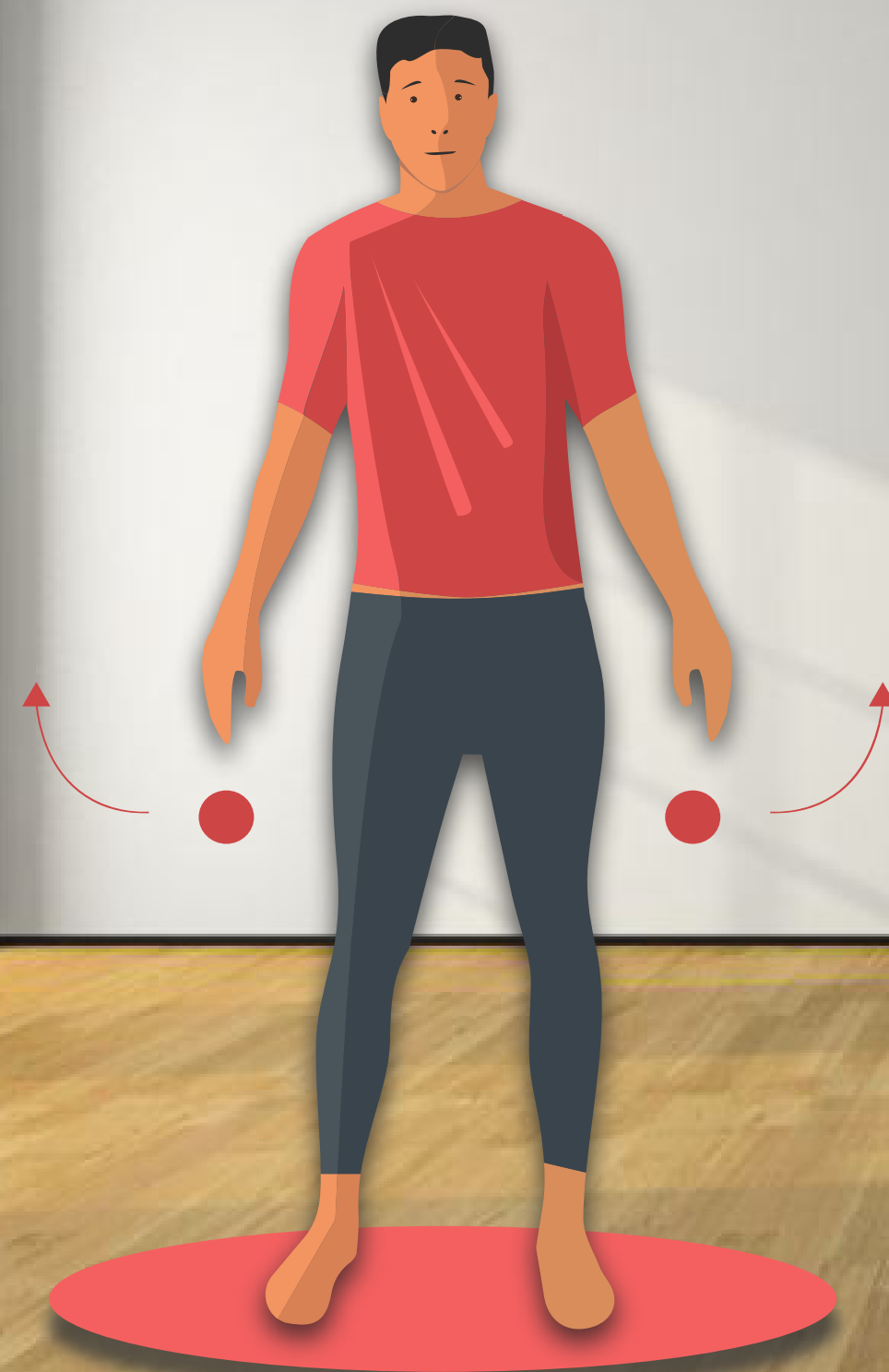
FOR HISTORY SWIPE DOWN

YOU ARE HERE



RAISE RIGHT HAND

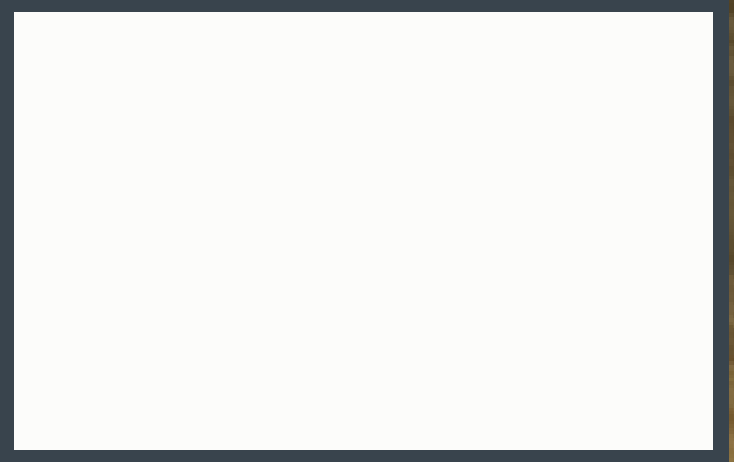
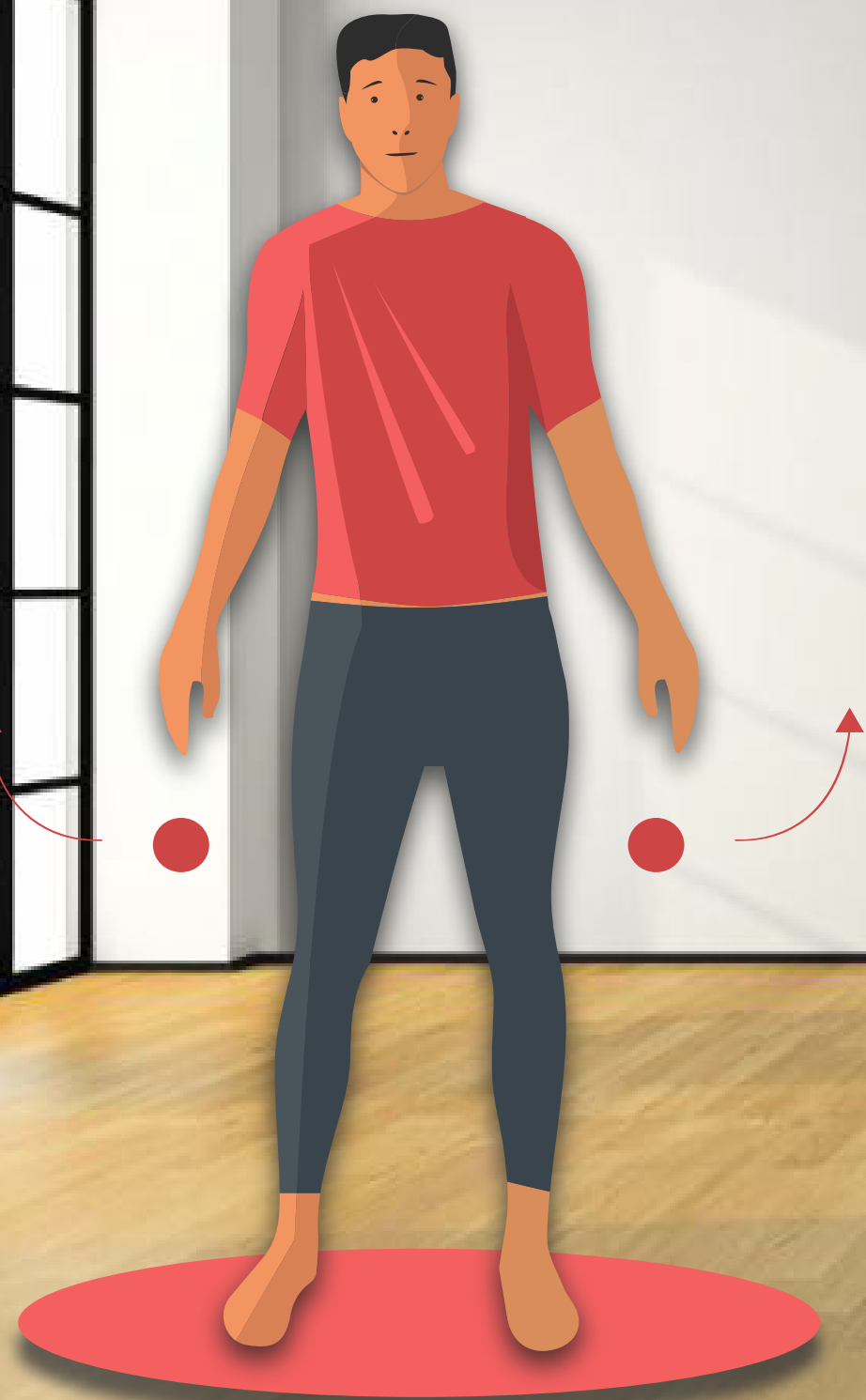
WHEN READY





0:31

4



EXERCISE PERFORMANCE

EXERCISE TIME

 0:39

REPETITIONS

5

REPEAT

SWIPE UP FOR MENU

NEXT



EXERCISE PERFORMANCE

EXERCISE TIME

 0:39

REPETITIONS

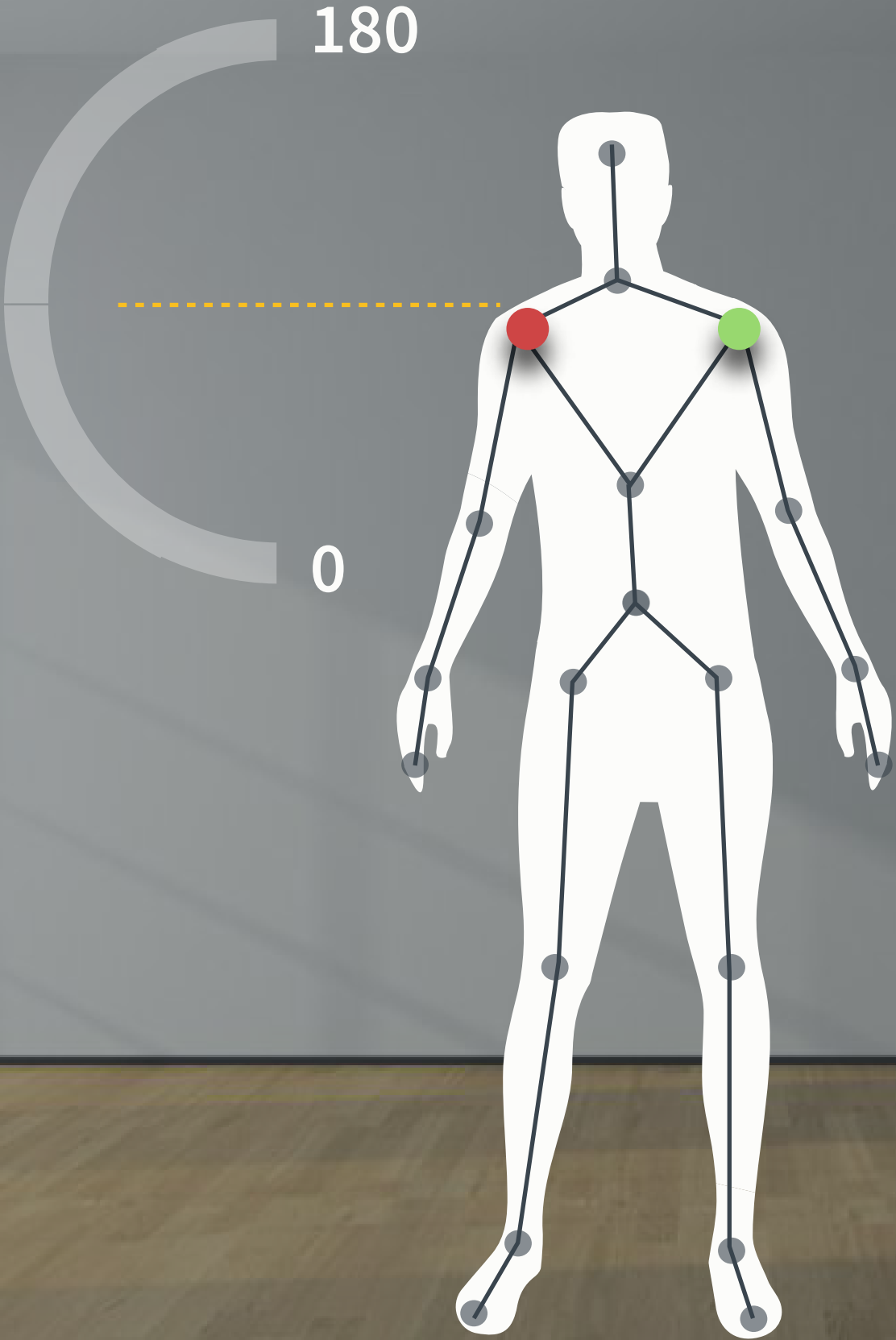
5

REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME



0:39

REPETITIONS

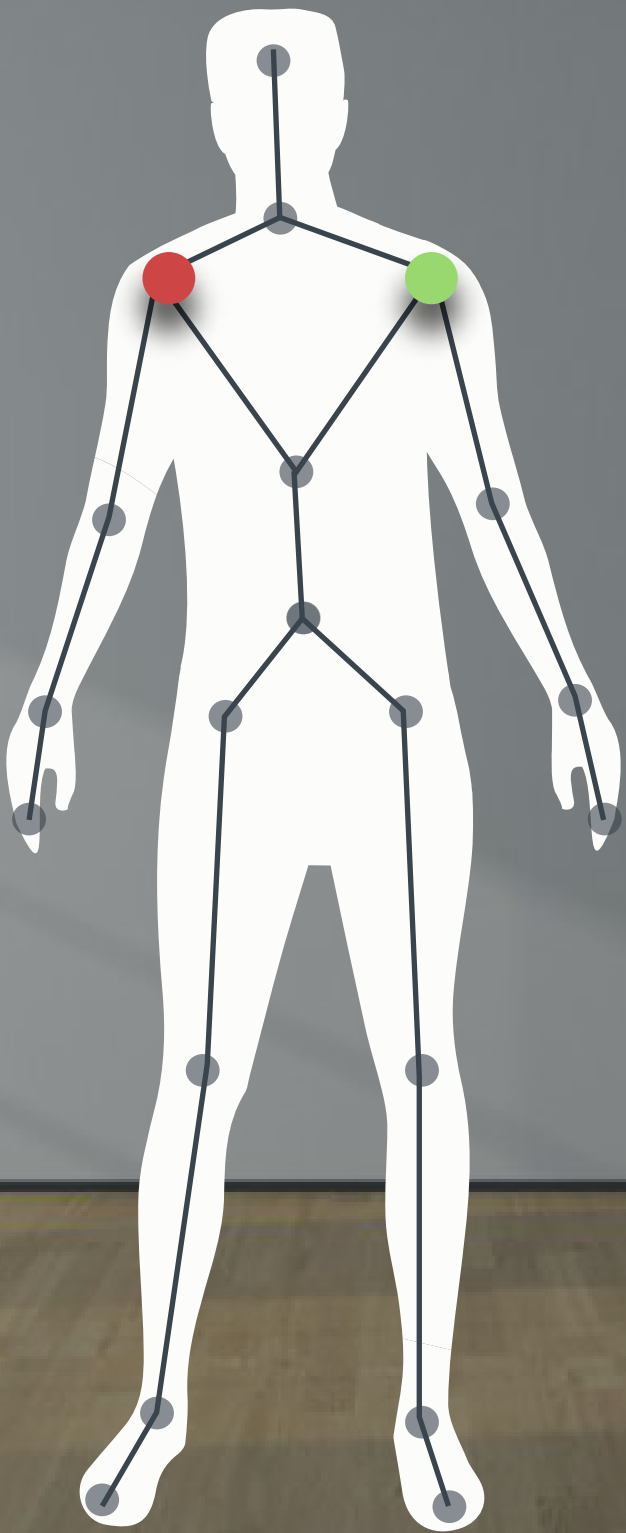
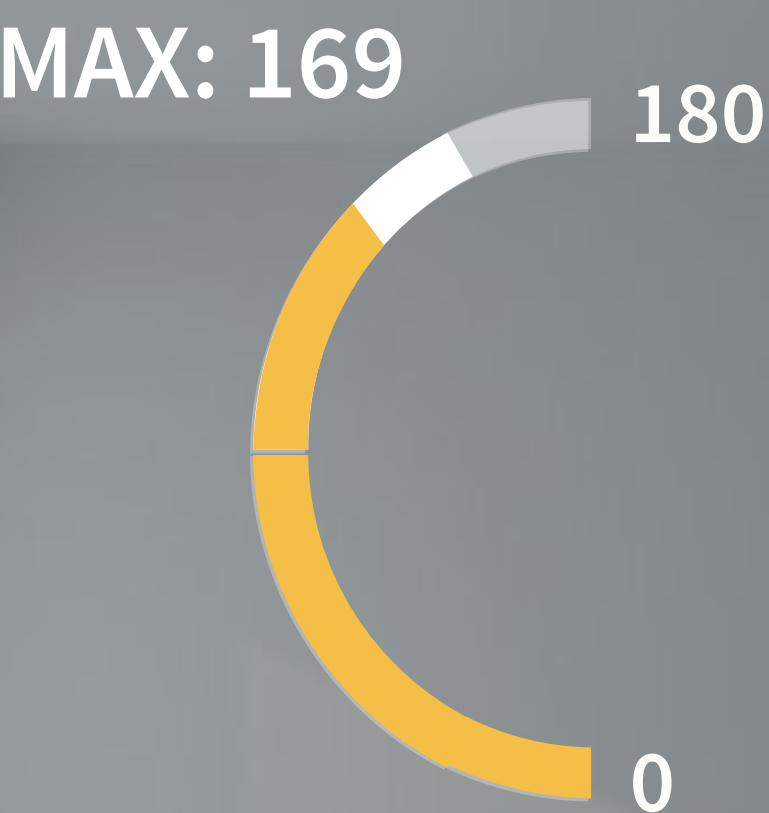


REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE



EXERCISE TIME



0:39

REPETITIONS



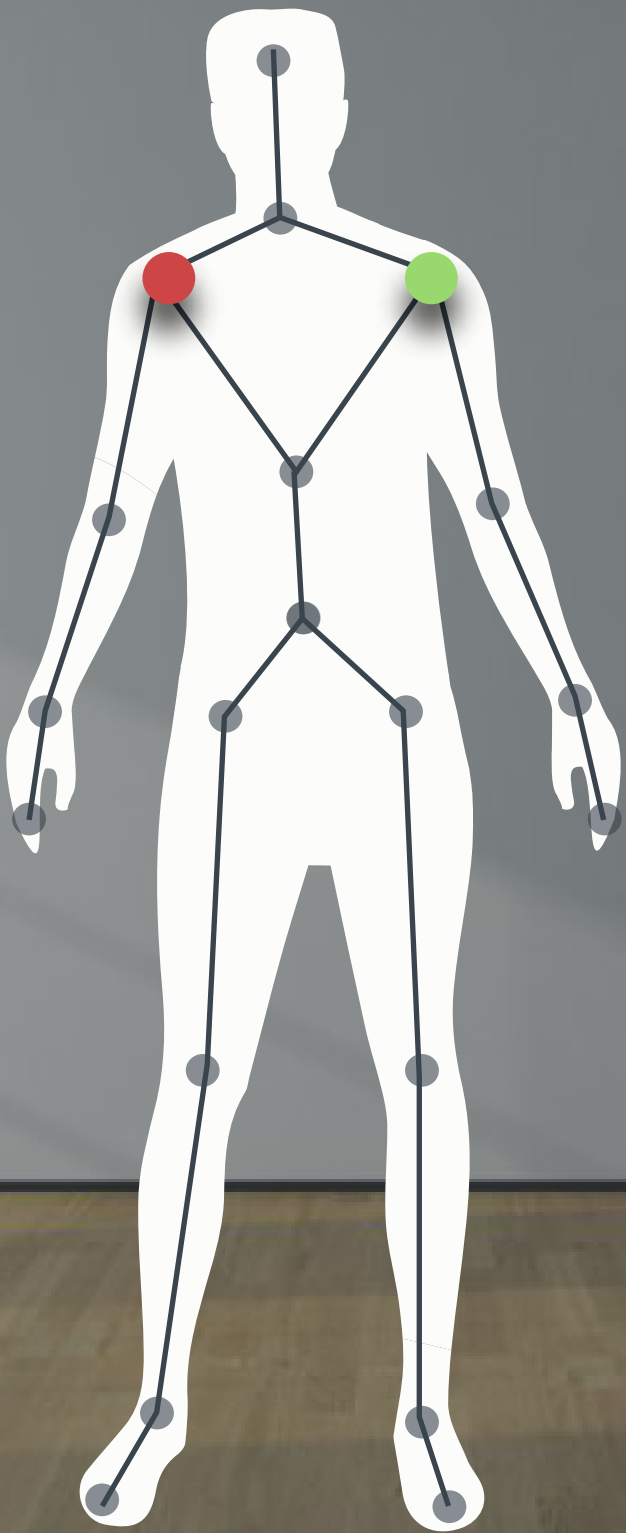
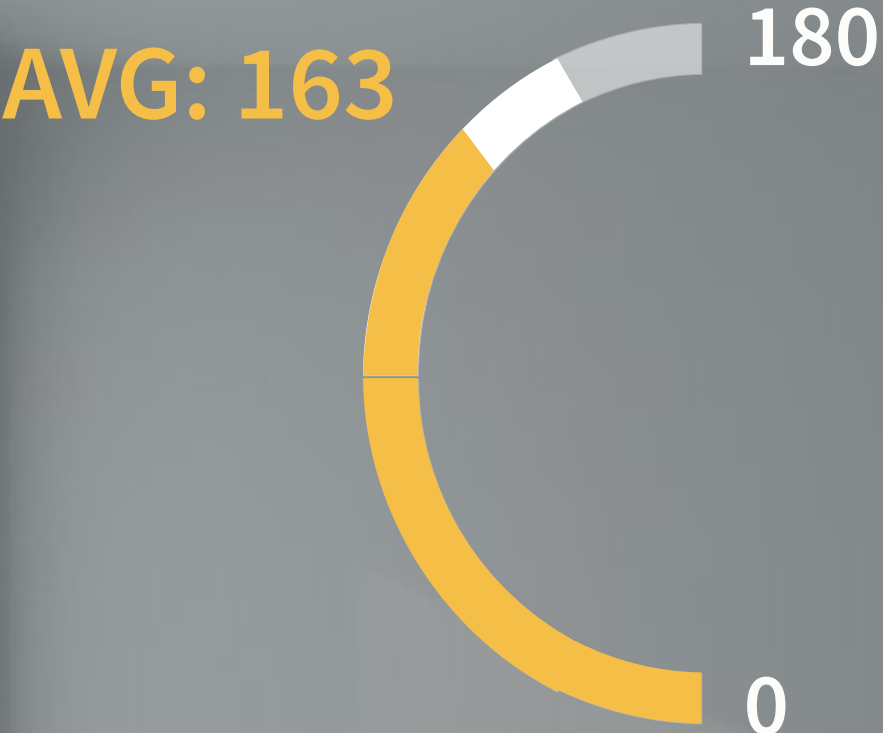
REPEAT

SWIPE UP FOR MENU

NEXT



EXERCISE PERFORMANCE



EXERCISE TIME



0:39

REPETITIONS



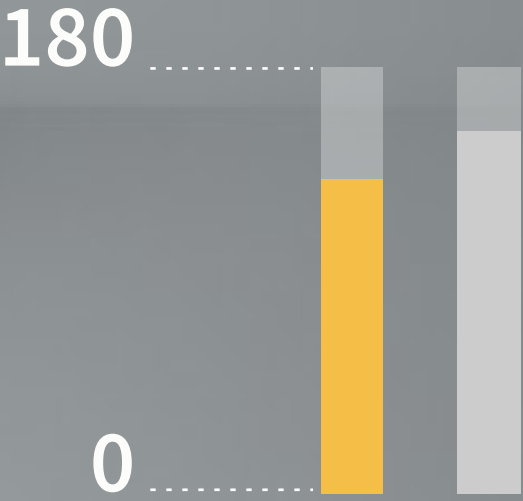
REPEAT

SWIPE UP FOR MENU

NEXT

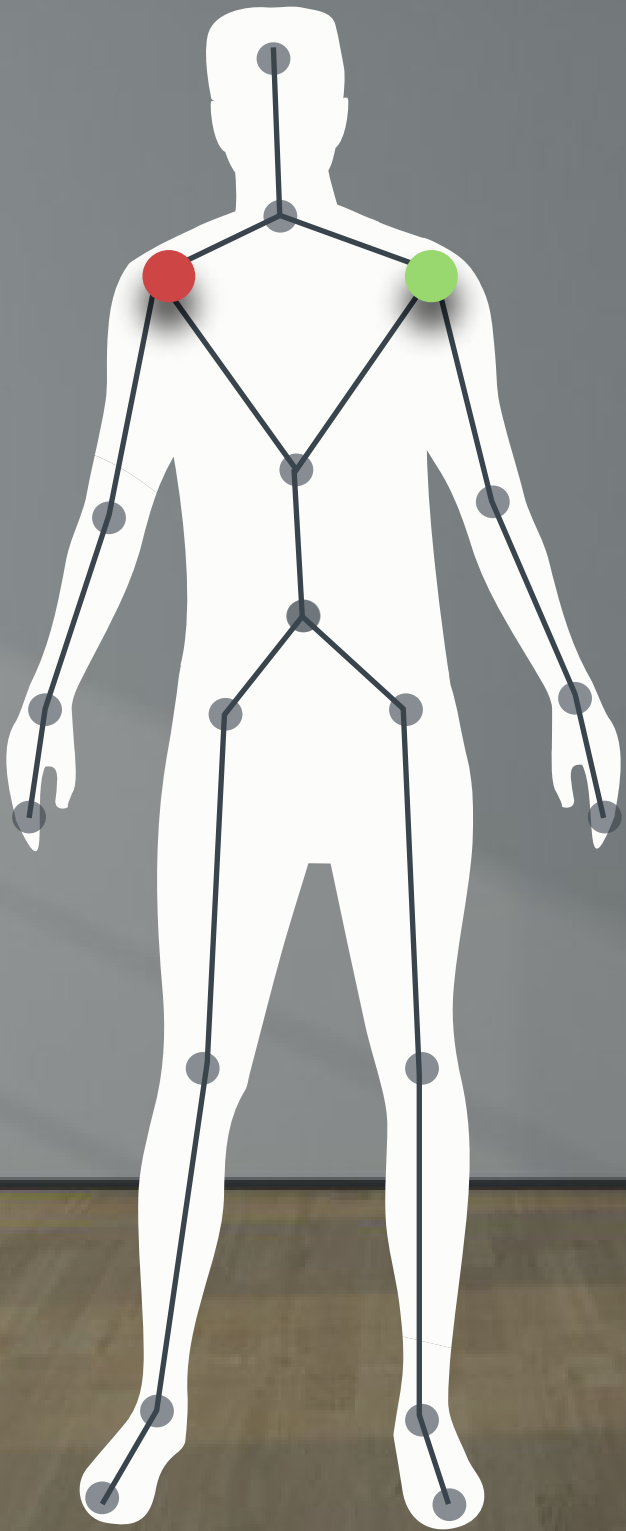


EXERCISE PERFORMANCE



Today
Avg : 163

Yesterday
Avg : 169



EXERCISE TIME



0:39

REPETITIONS

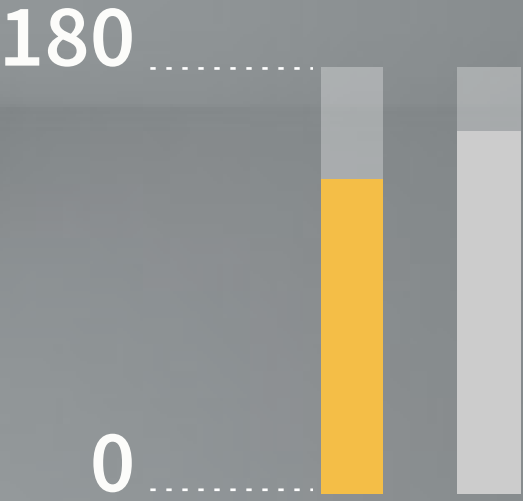


REPEAT

SWIPE UP FOR MENU

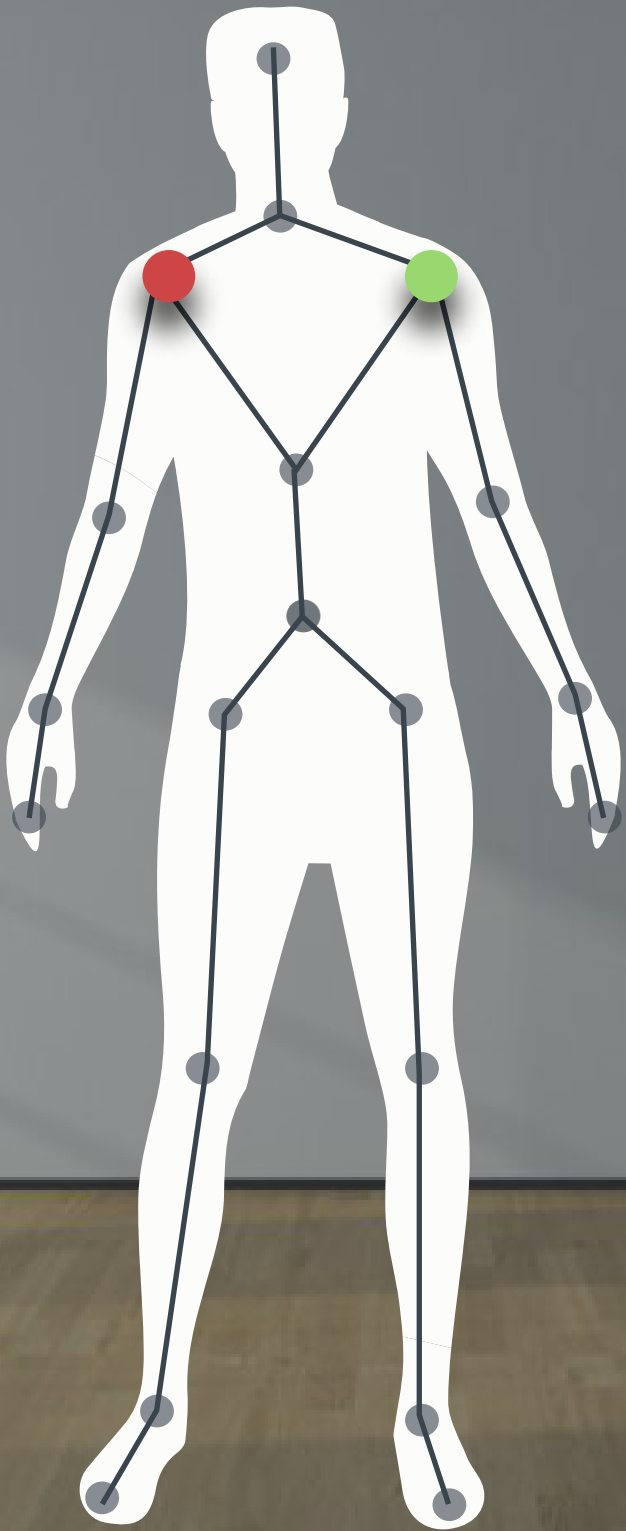
NEXT

EXERCISE PERFORMANCE



Today
Avg : 163

Yesterday
Avg : 169



EXERCISE TIME



0:39

REPETITIONS



REPEAT

SWIPE UP FOR MENU

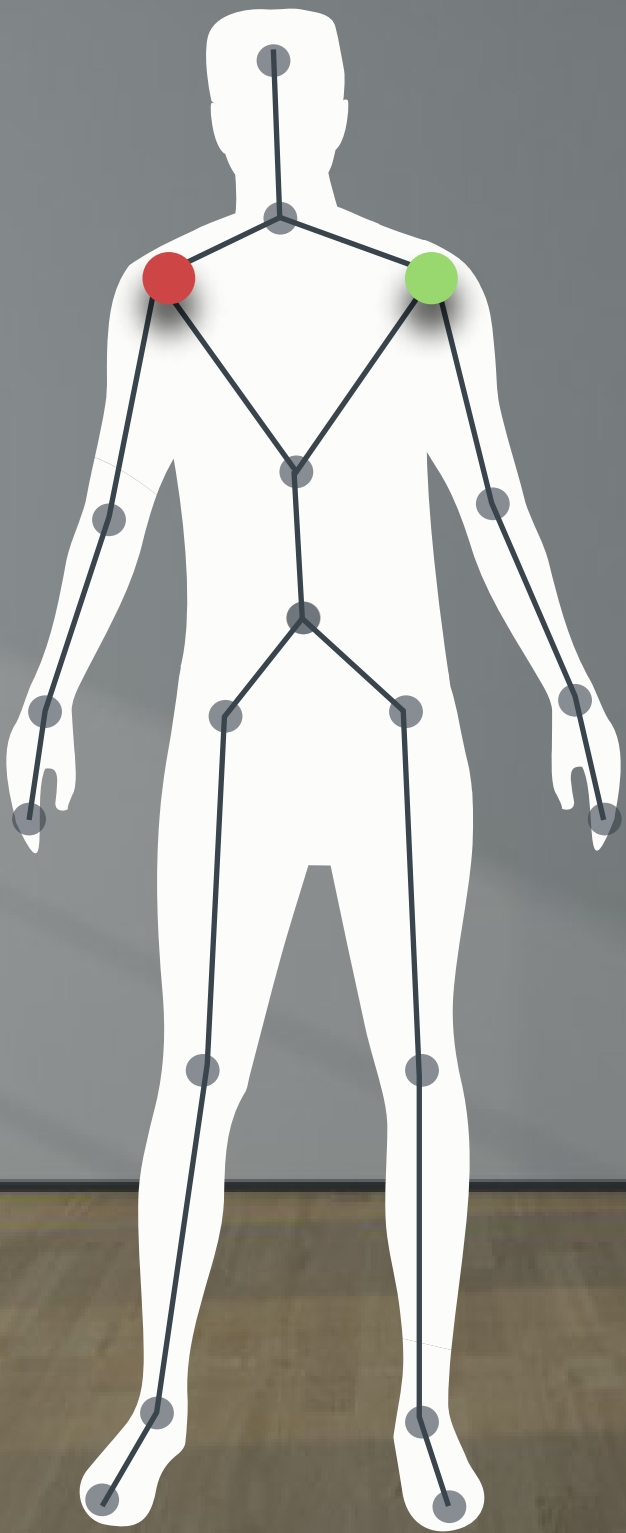
NEXT

EXERCISE PERFORMANCE

4%

Deterioration

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



EXERCISE TIME



0:39

REPETITIONS

5



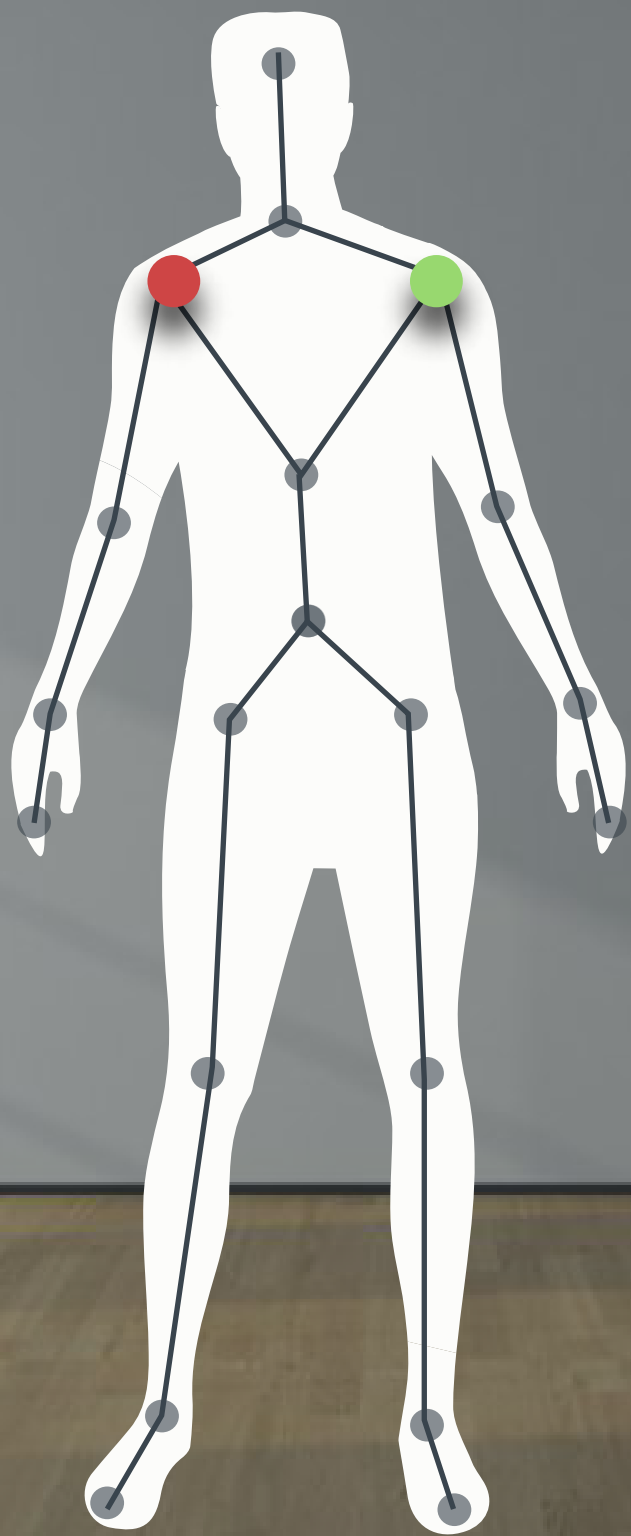
REPEAT

SWIPE UP FOR MENU

NEXT



EXERCISE PERFORMANCE



EXERCISE TIME



0:39

REPETITIONS



REPEAT

SWIPE UP FOR MENU

NEXT

EXERCISE PERFORMANCE

OVERALL PROGRESS

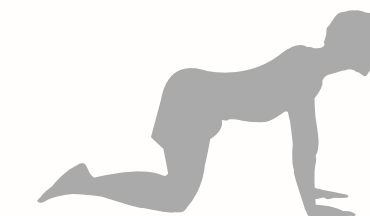
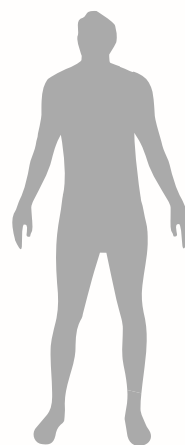
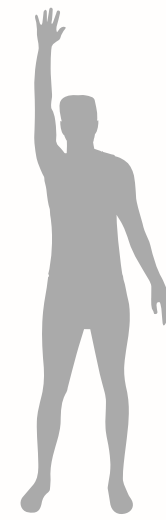
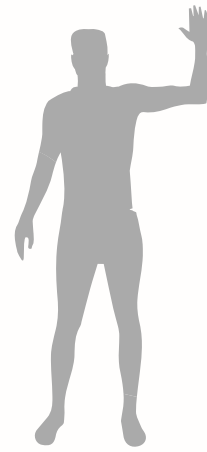


REPEAT

SWIPE UP FOR MENU

NEXT

YOU ARE HERE



RAISE RIGHT HAND

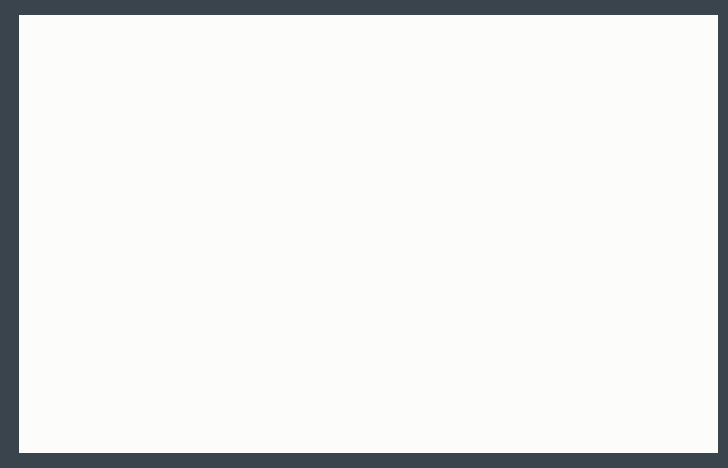
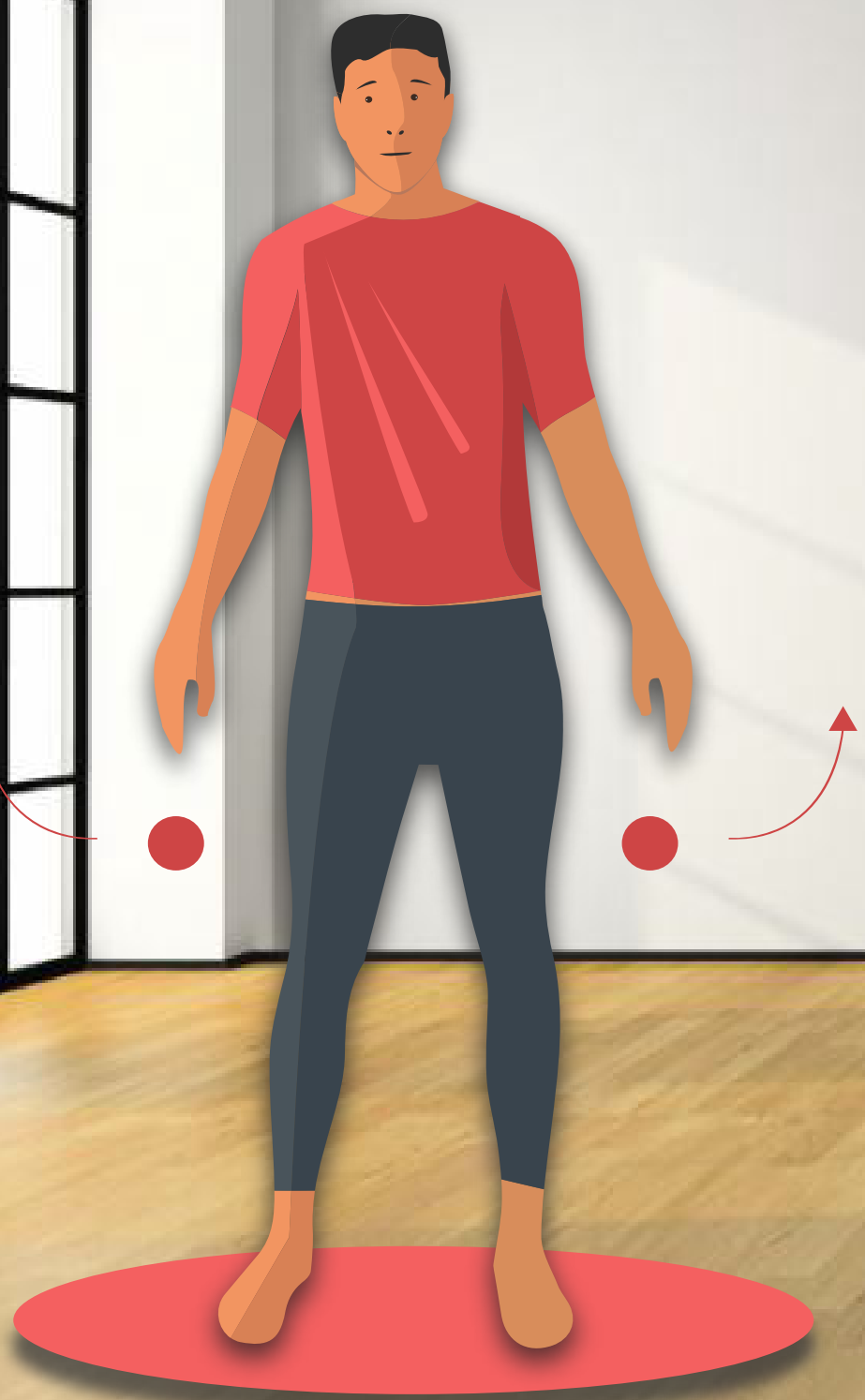
WHEN READY





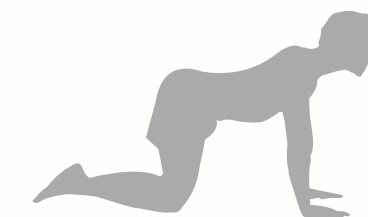
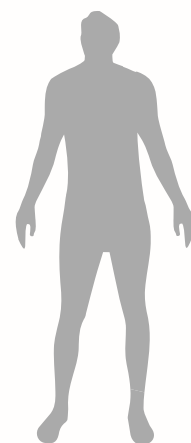
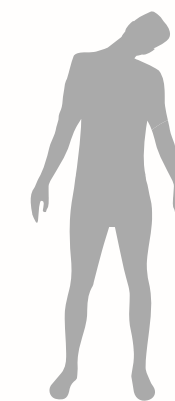
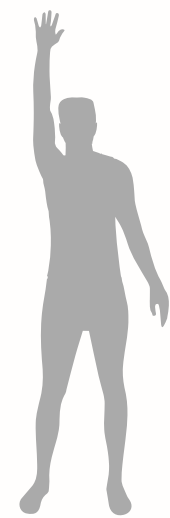
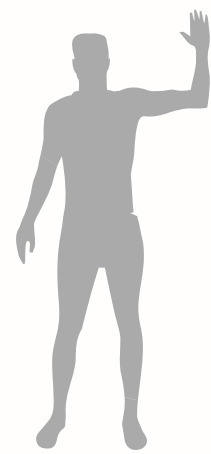
0:31

4



SESSION FEEDBACK

OVERALL PERFORMANCE



SESSION PERFORMANCE

SESSION TIME



10:49

MENU

SWIPE UP TO QUIT

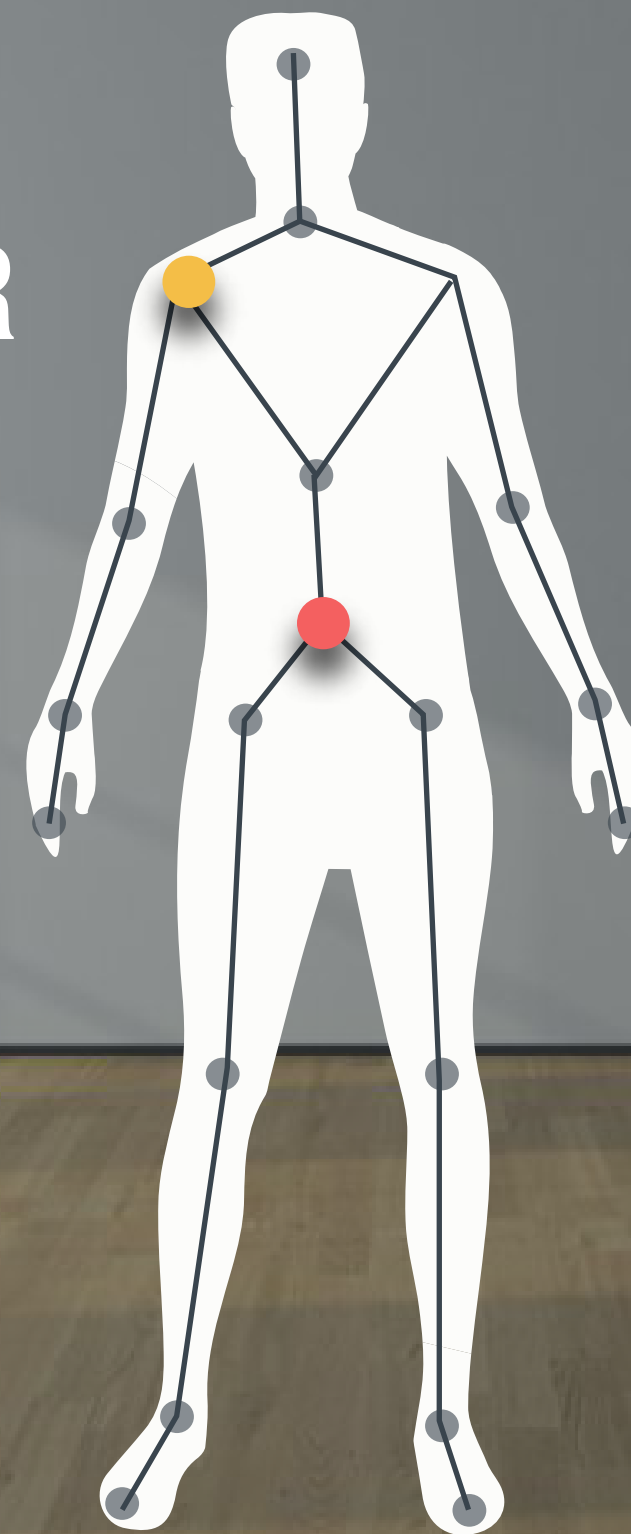
GAMES

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

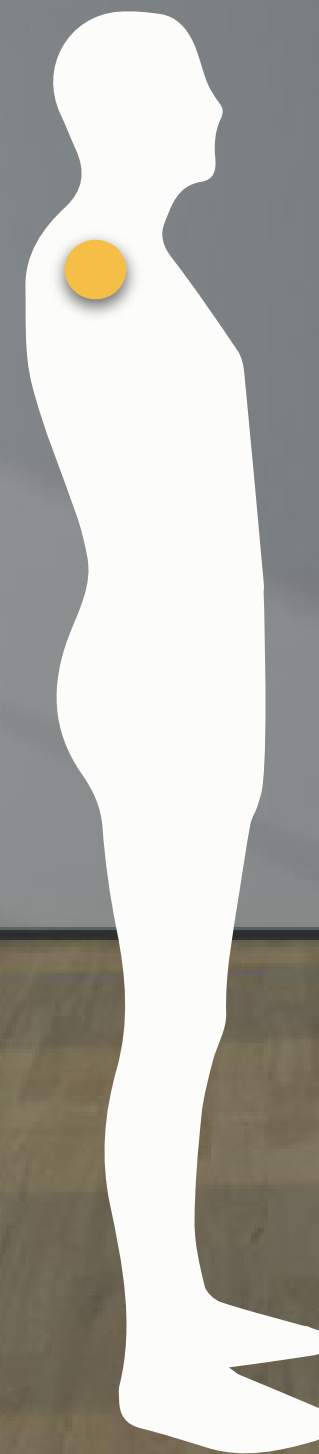
SWIPE UP TO QUIT

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

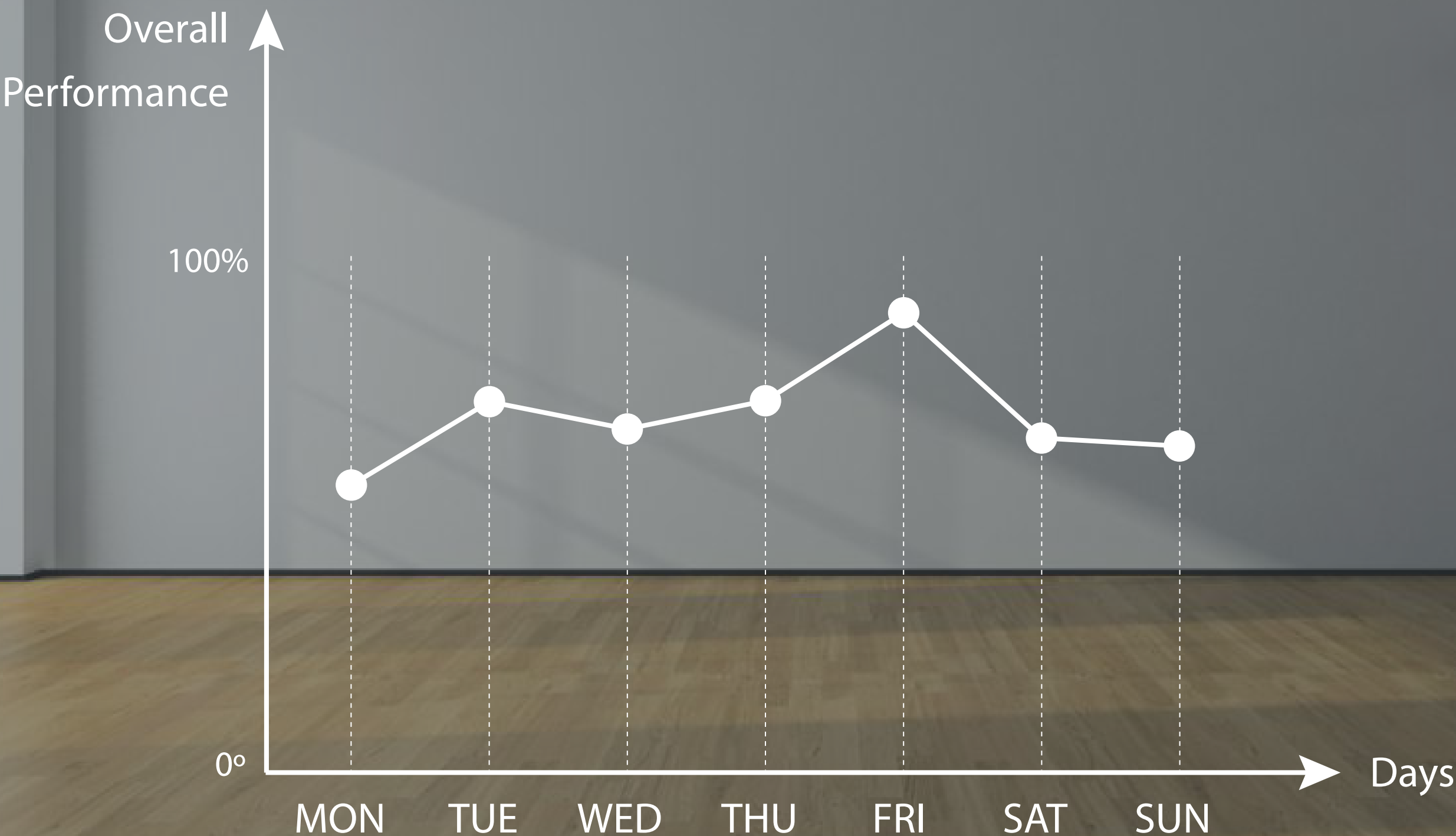
GAMES



DAY 7

WEEKLY SESSION PERFORMANCE

OVERALL PERFORMANCE vs DAY



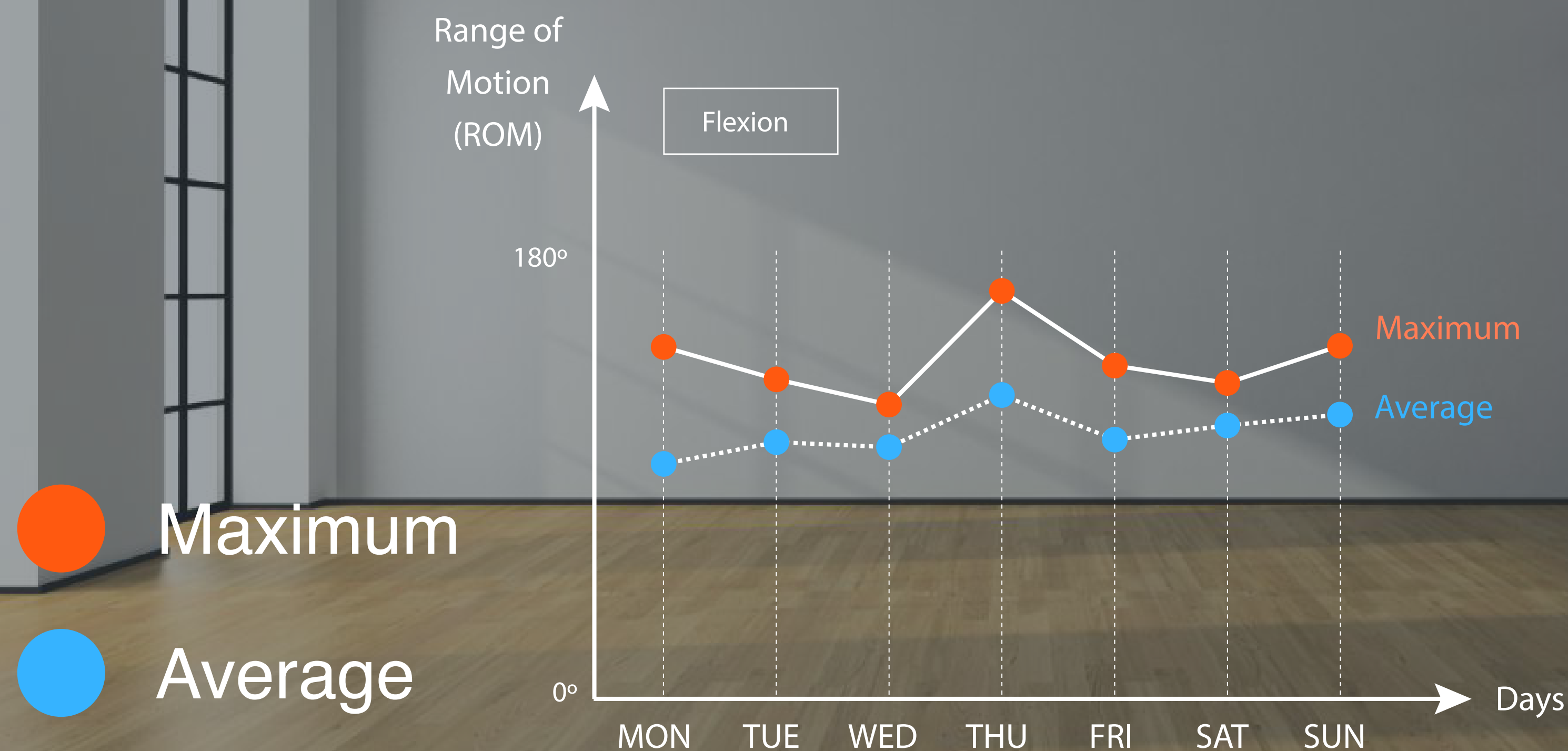
MENU

SWIPE UP TO QUIT

GAMES

WEEKLY SESSION PERFORMANCE

RANGE OF MOTION vs DAY



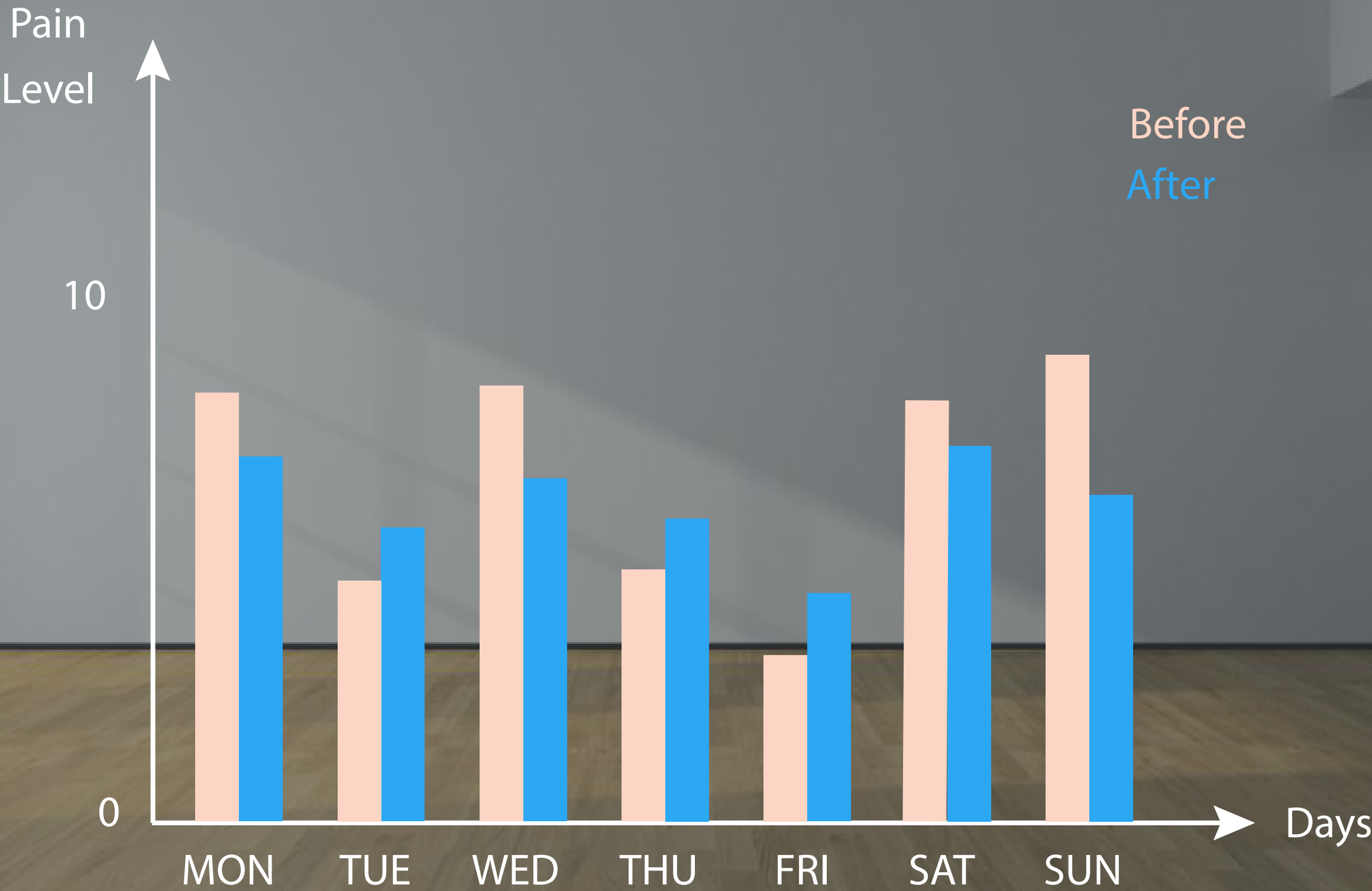
MENU

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

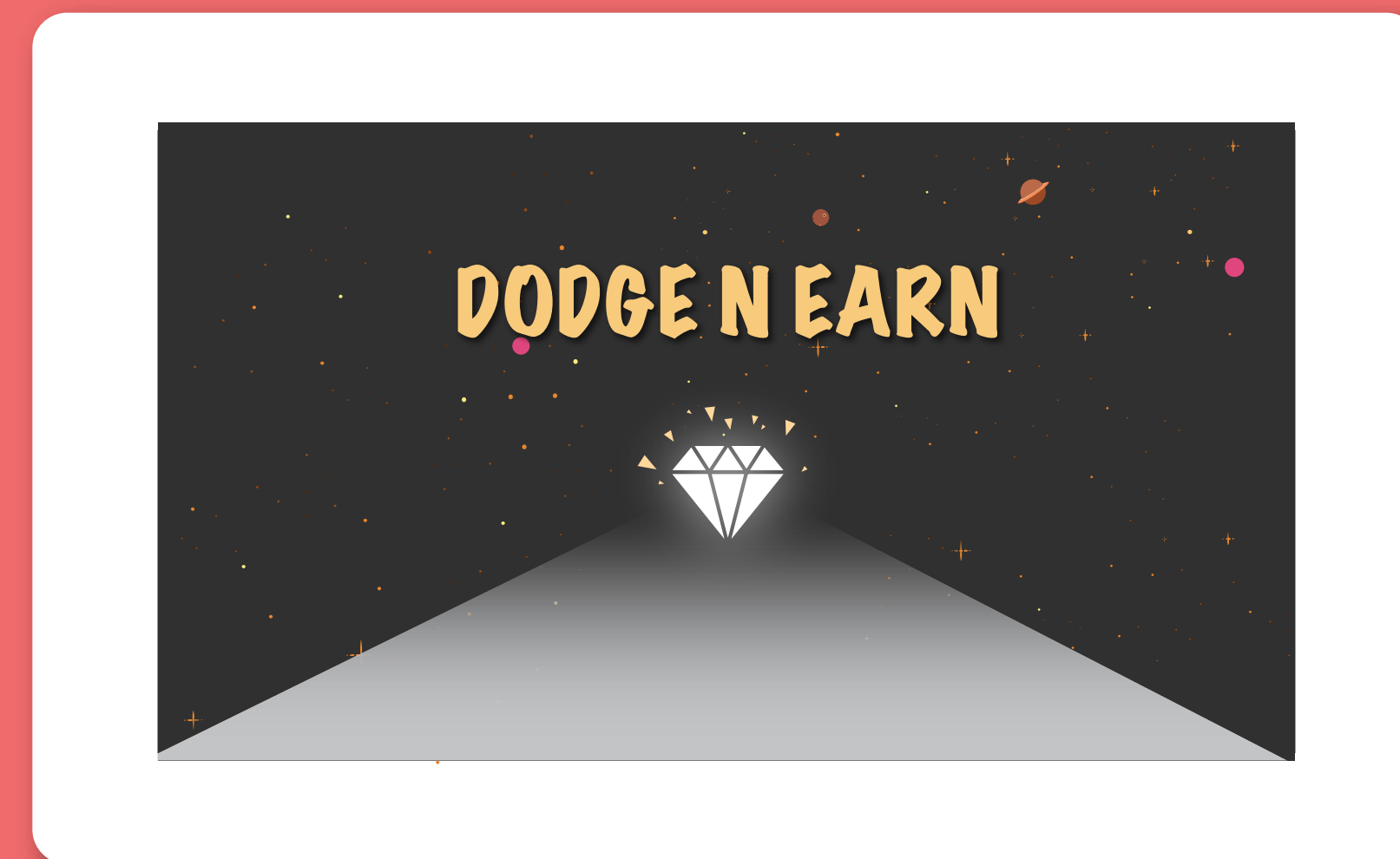


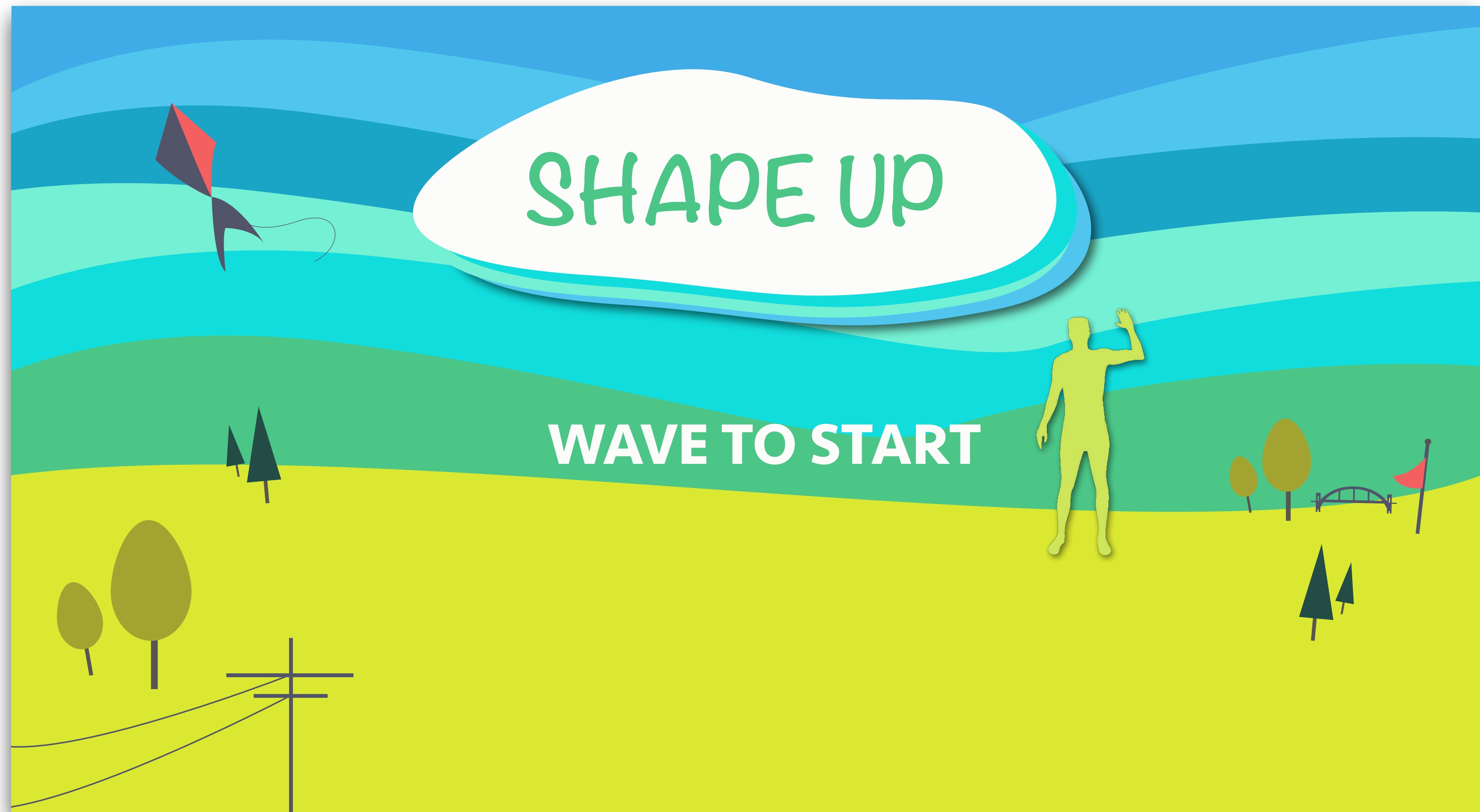
TO PLAY GAMES

RAISE RIGHT HAND



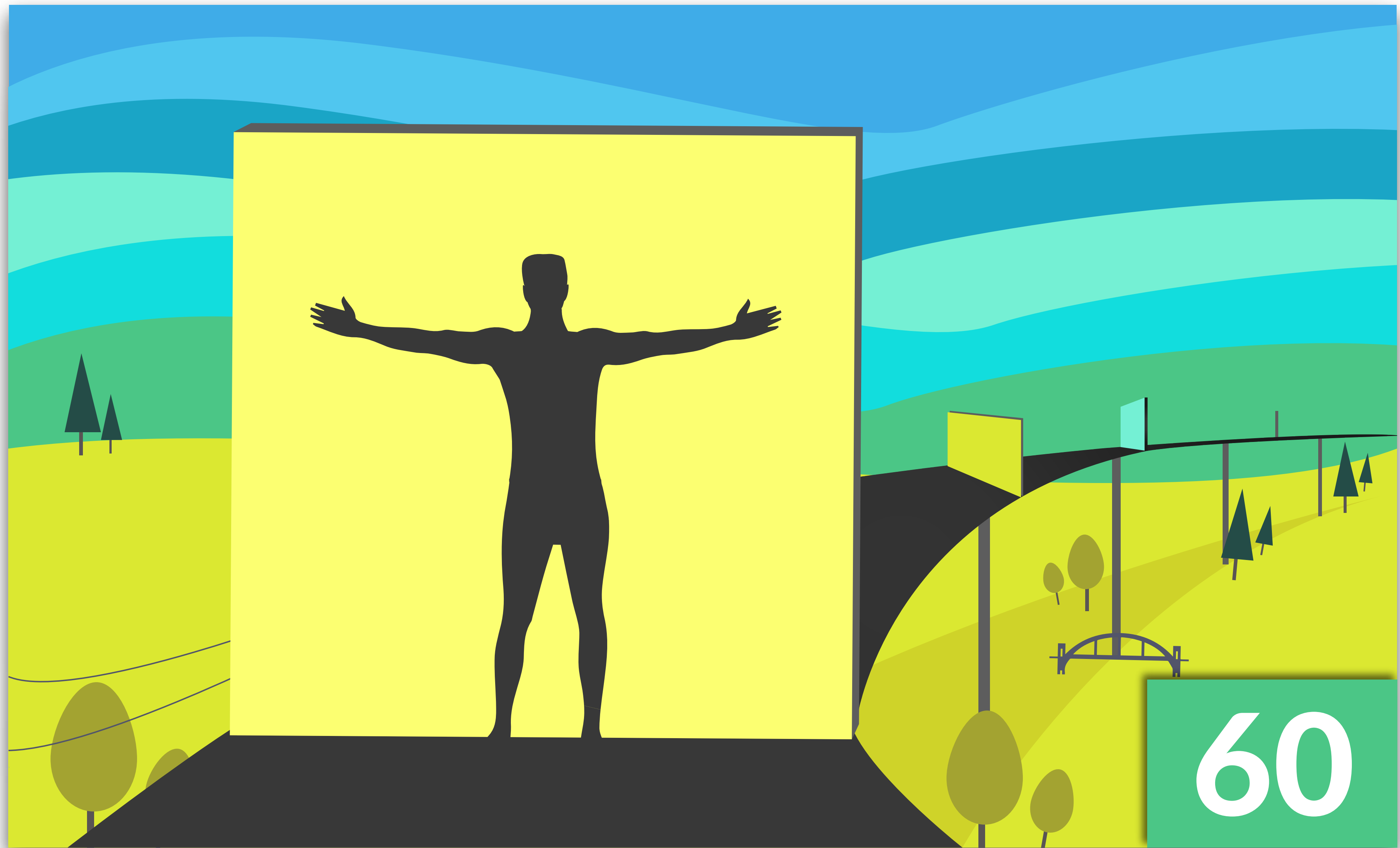
FOR HISTORY SWIPE DOWN

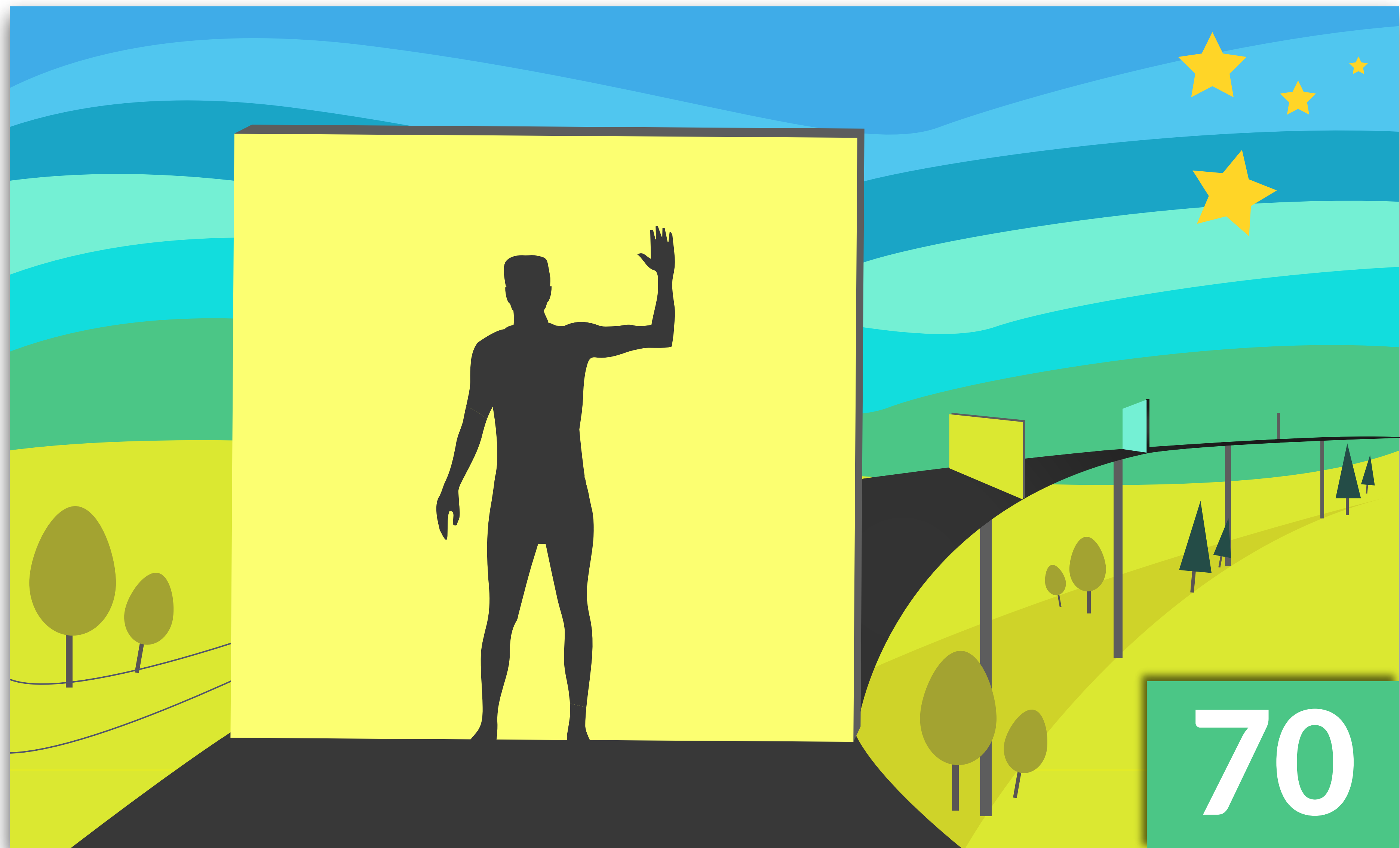




SHAPE UP

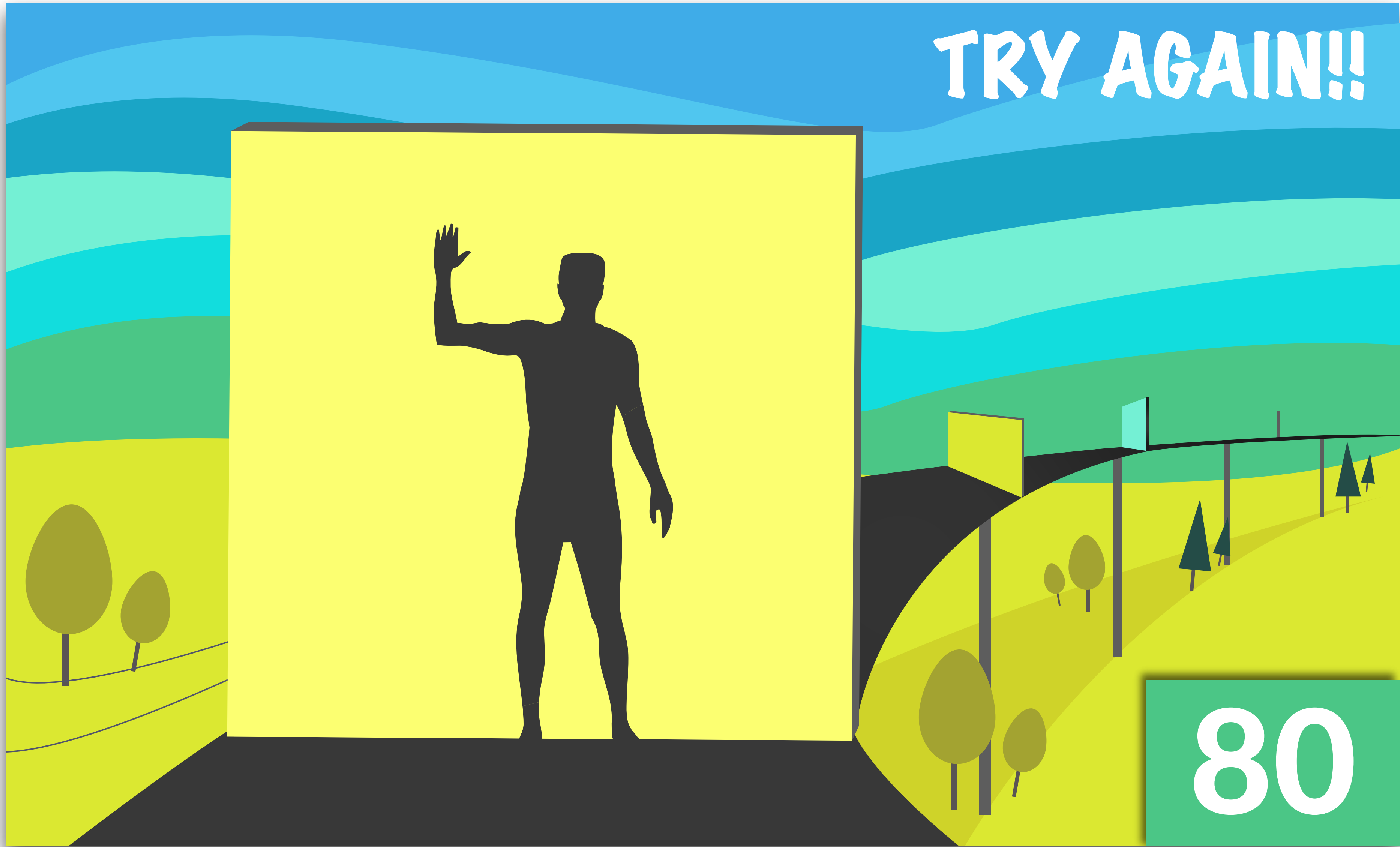
WAVE TO START

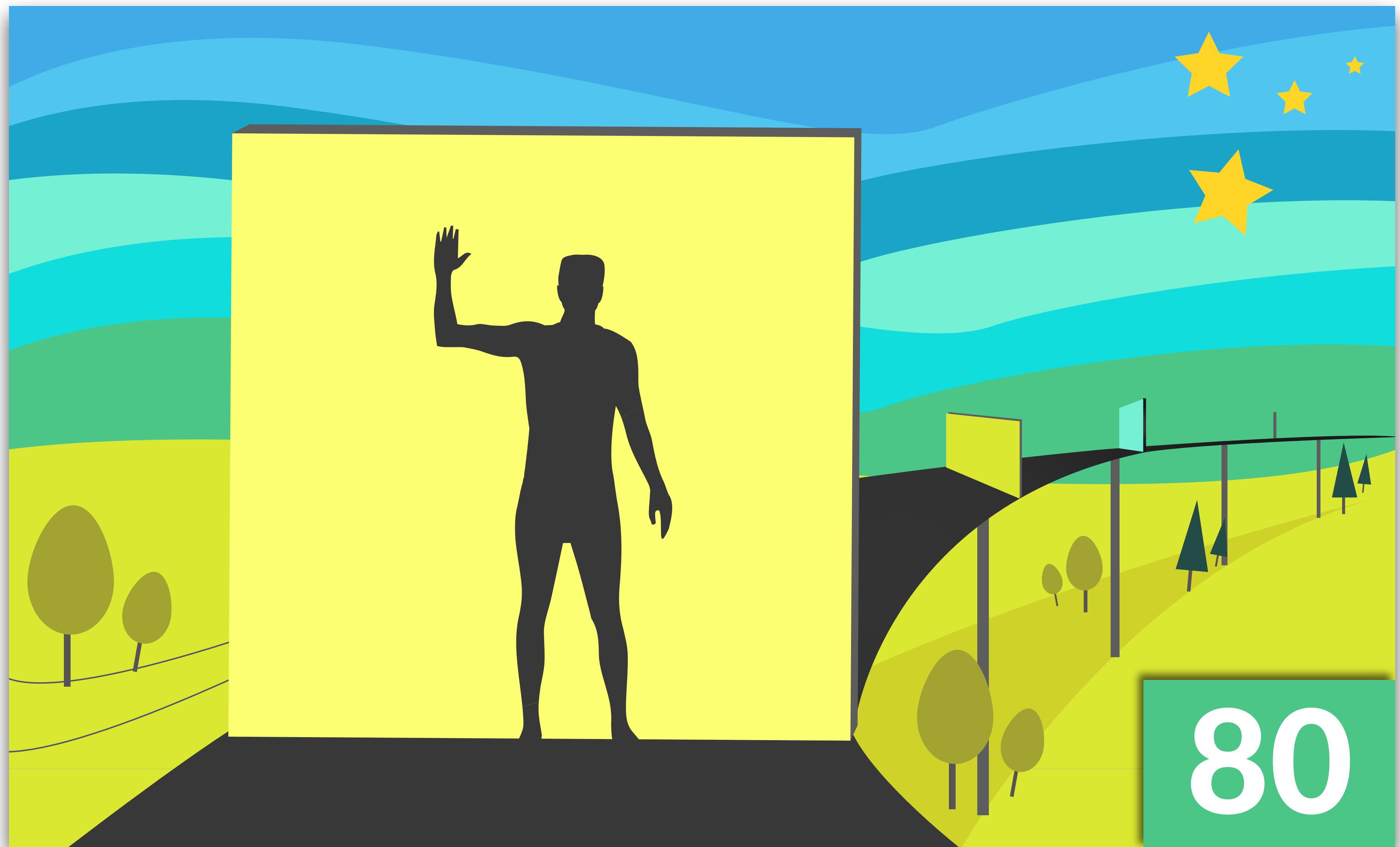


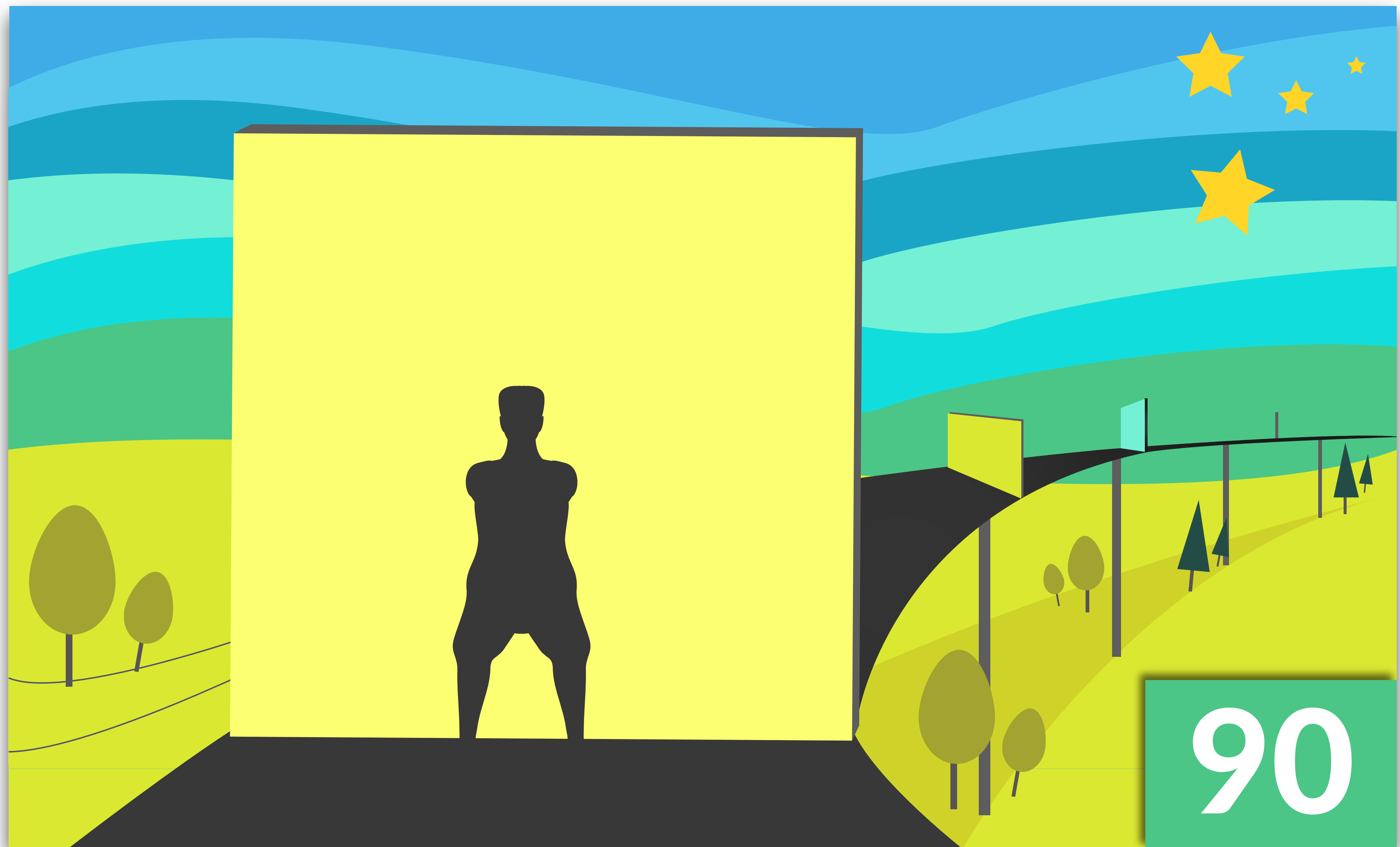


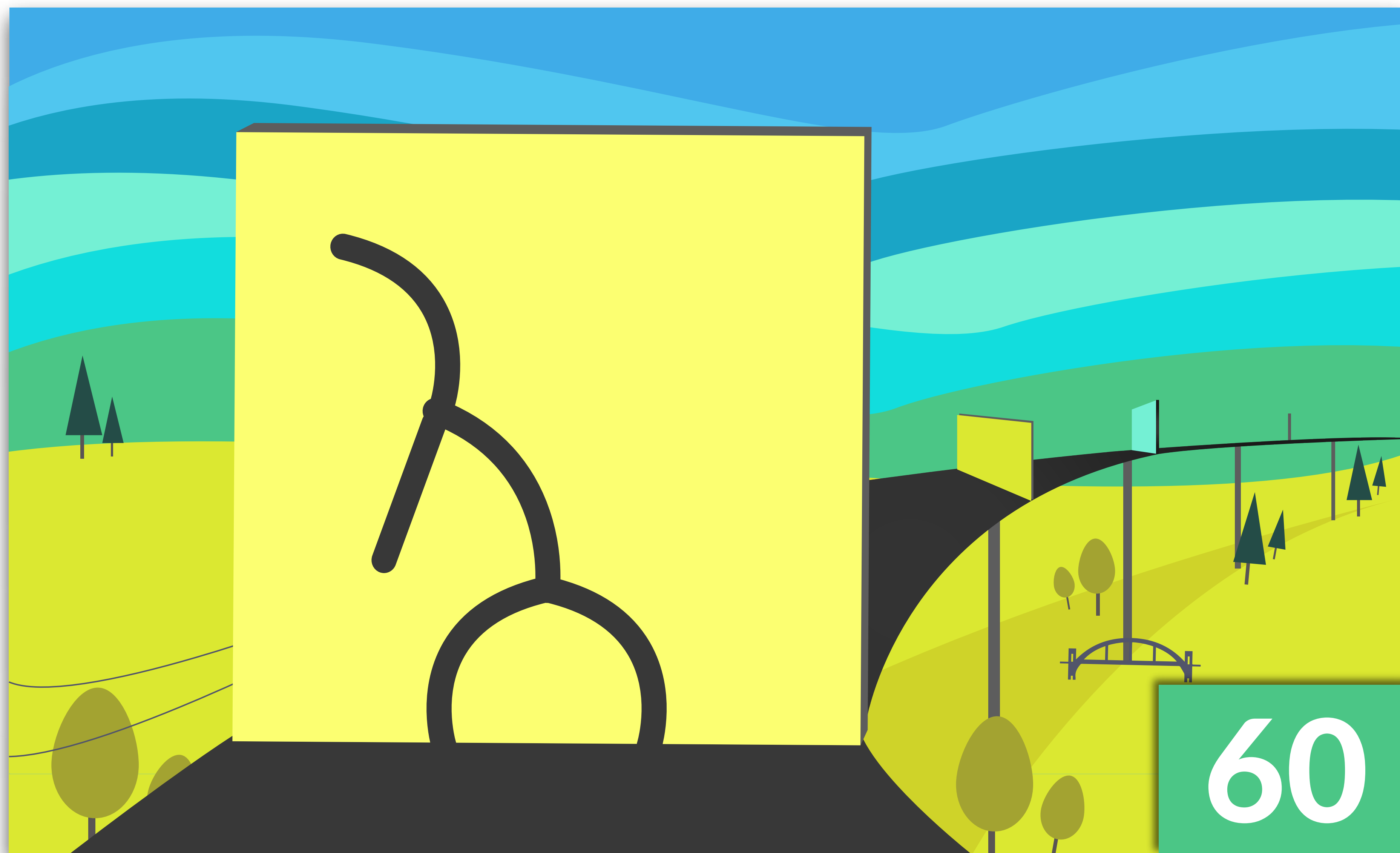
TRY AGAIN!!

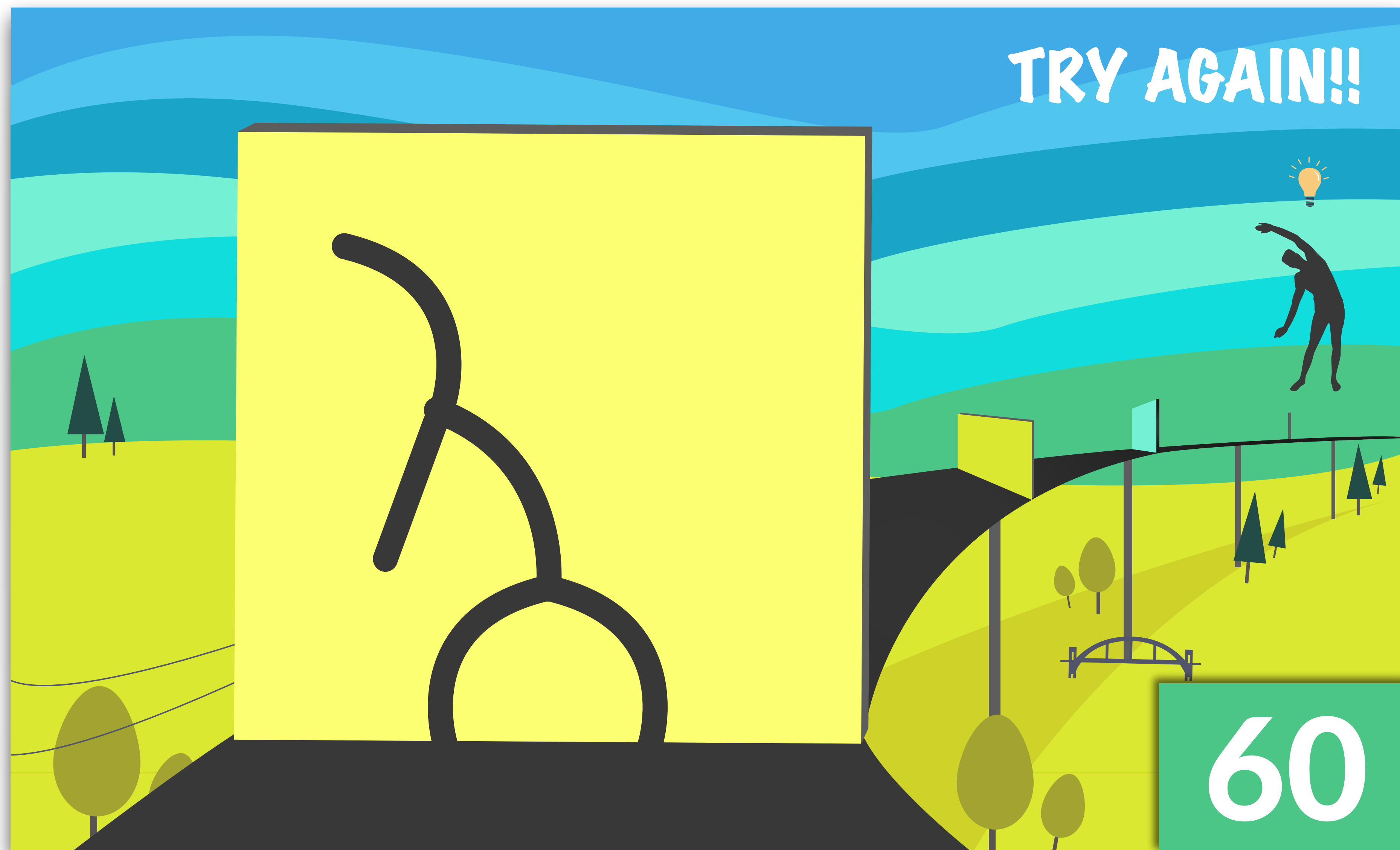
80

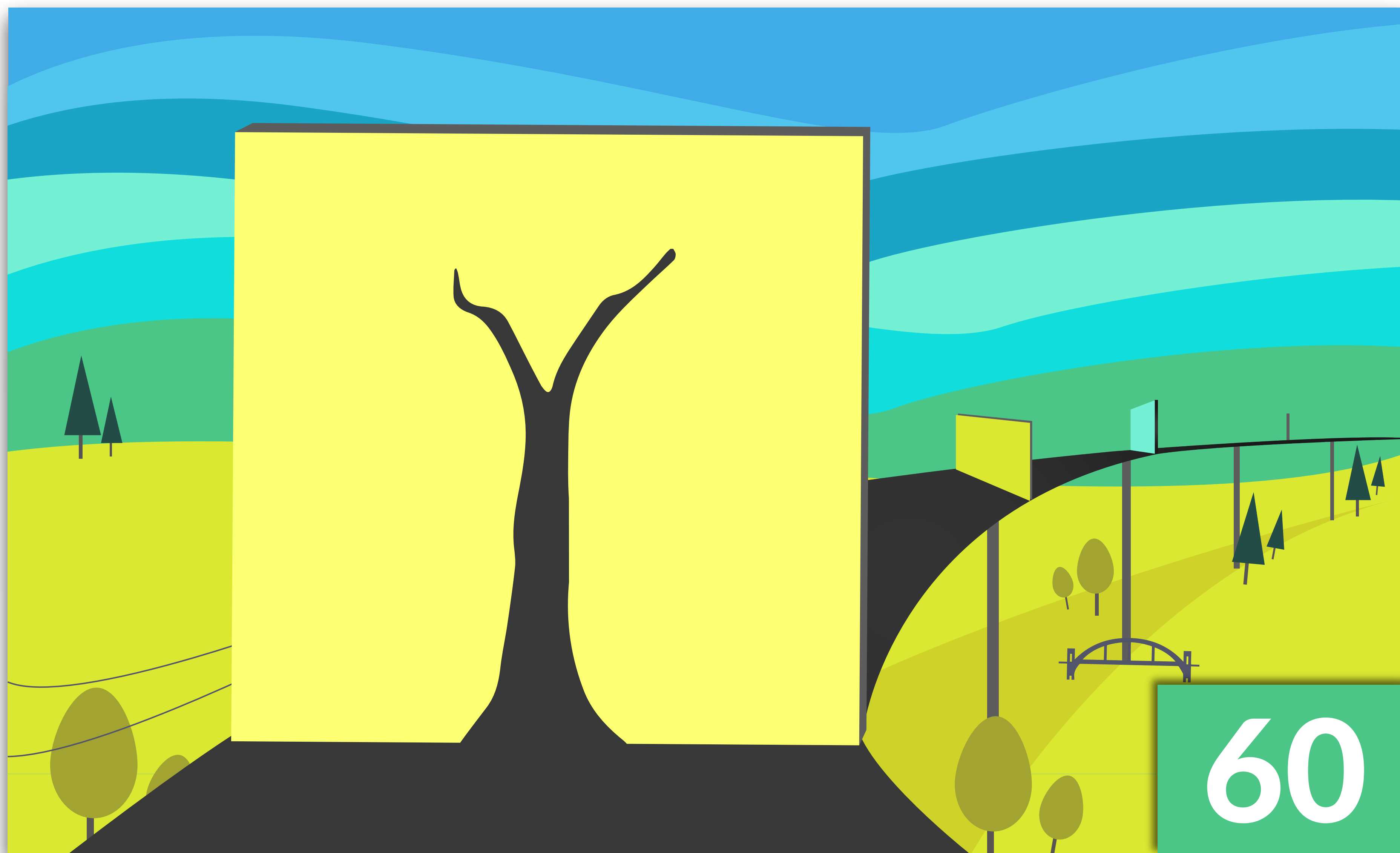




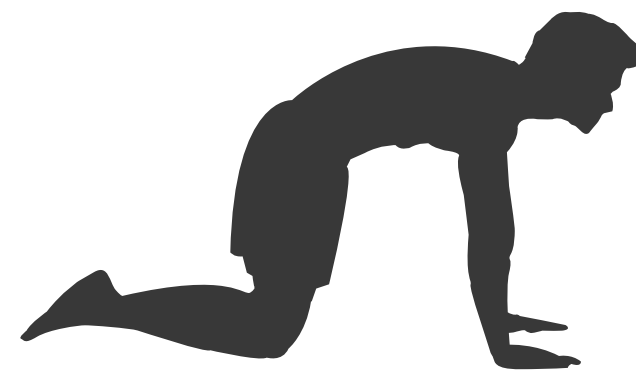
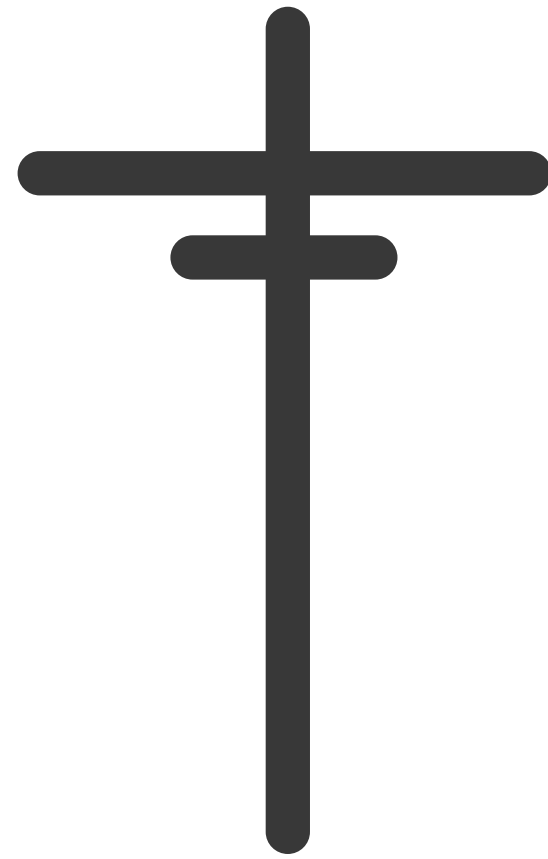
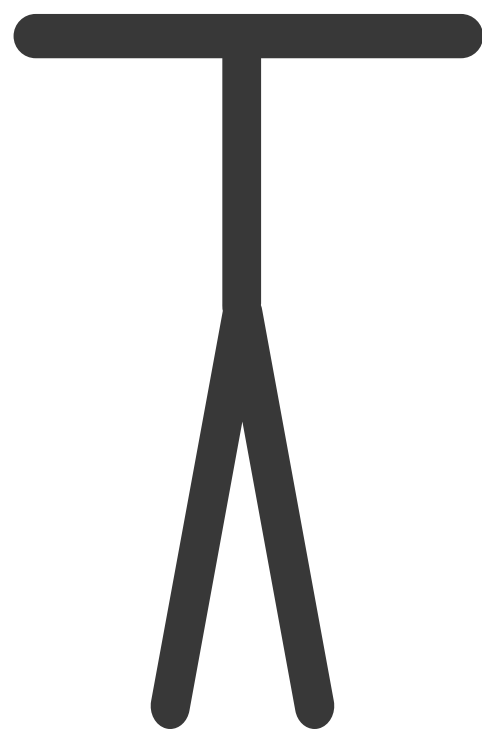
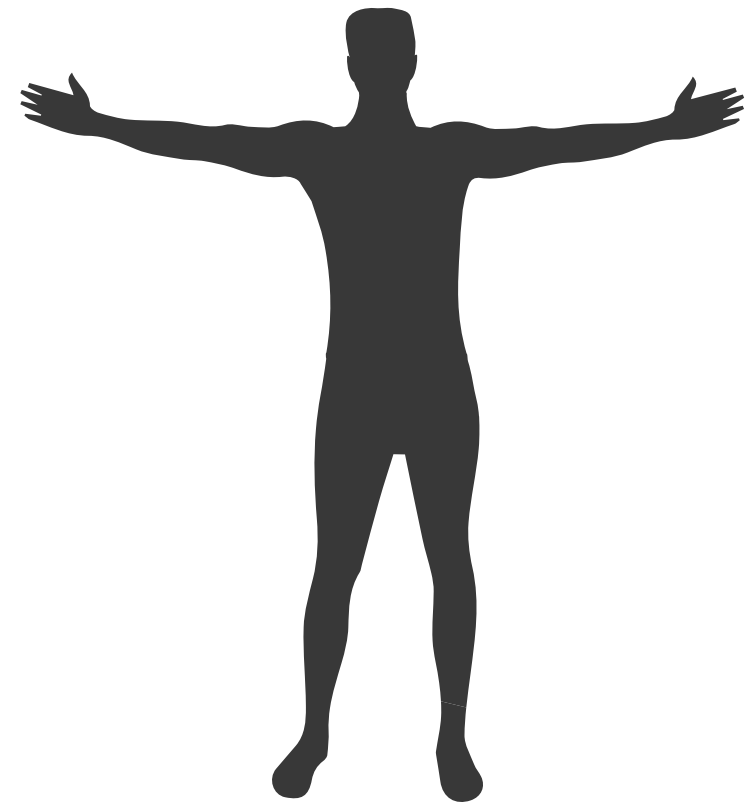
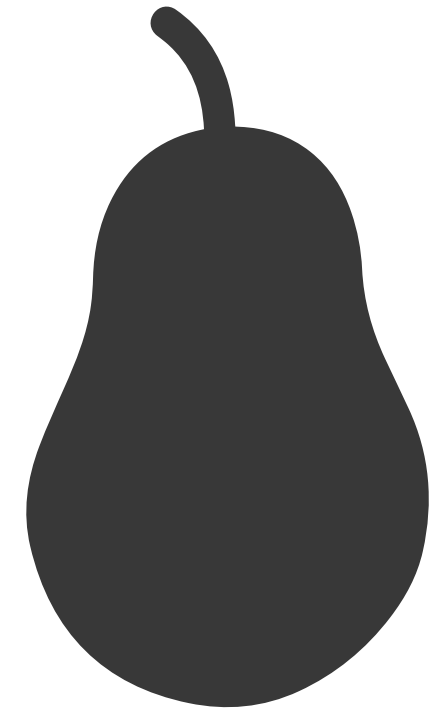
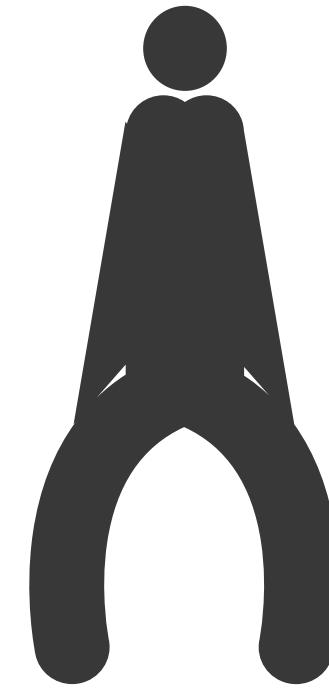
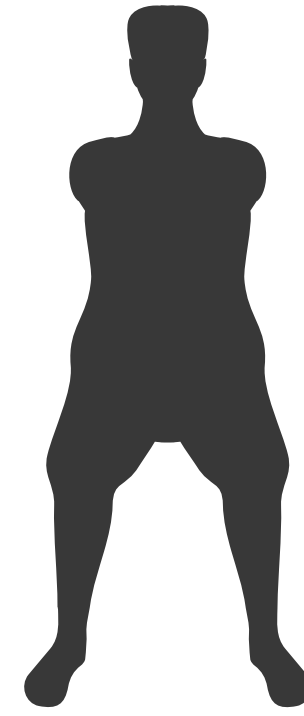
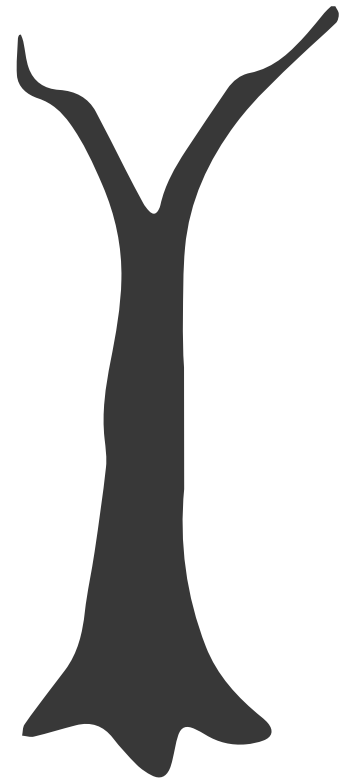
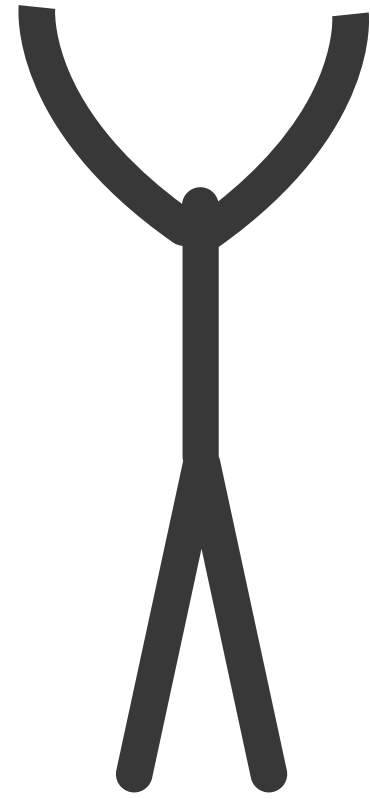
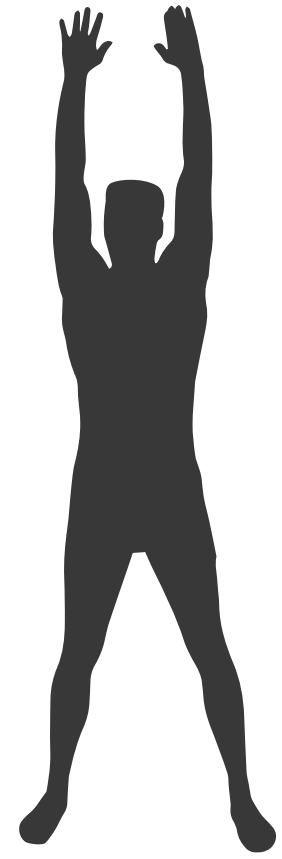






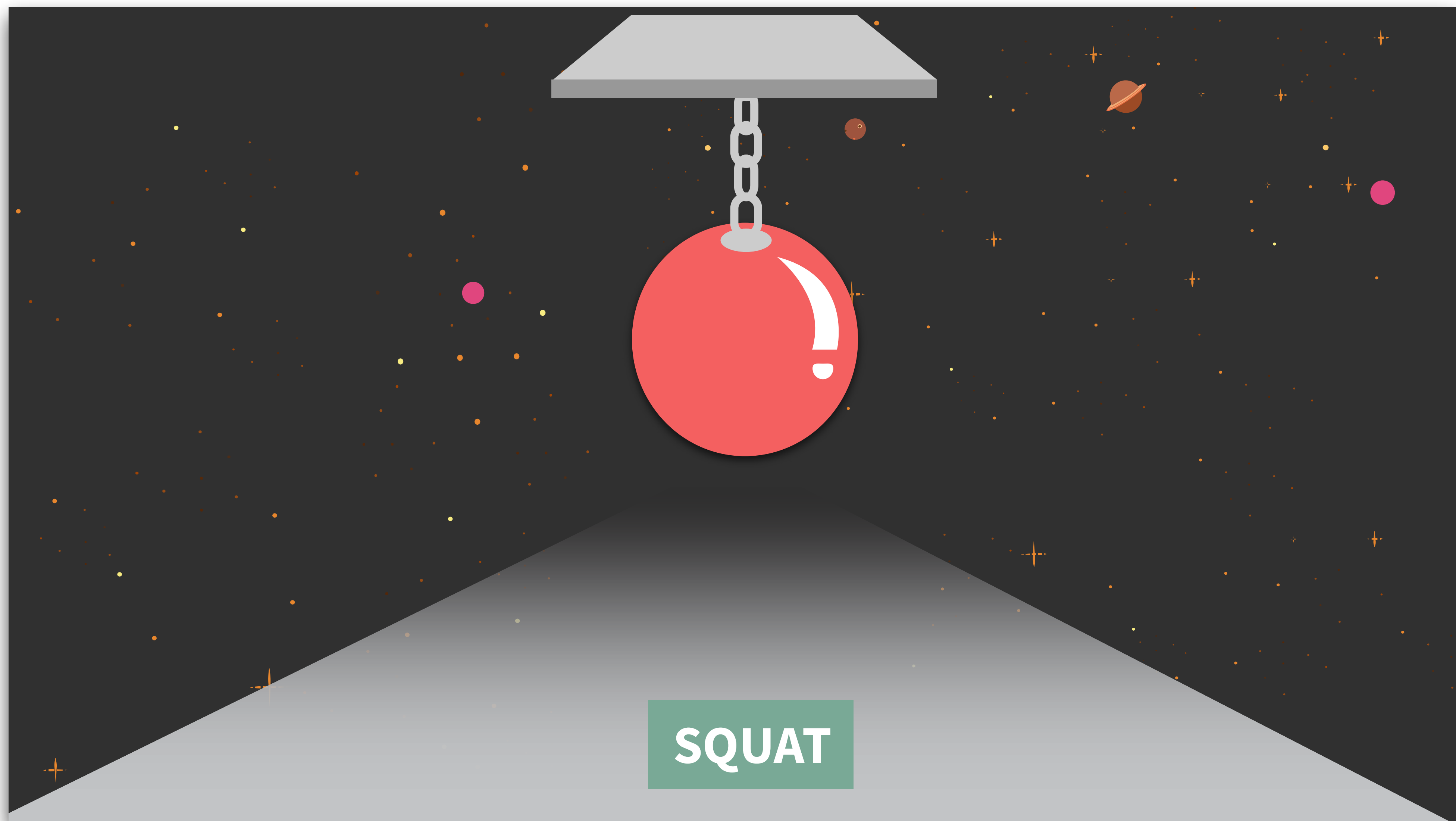


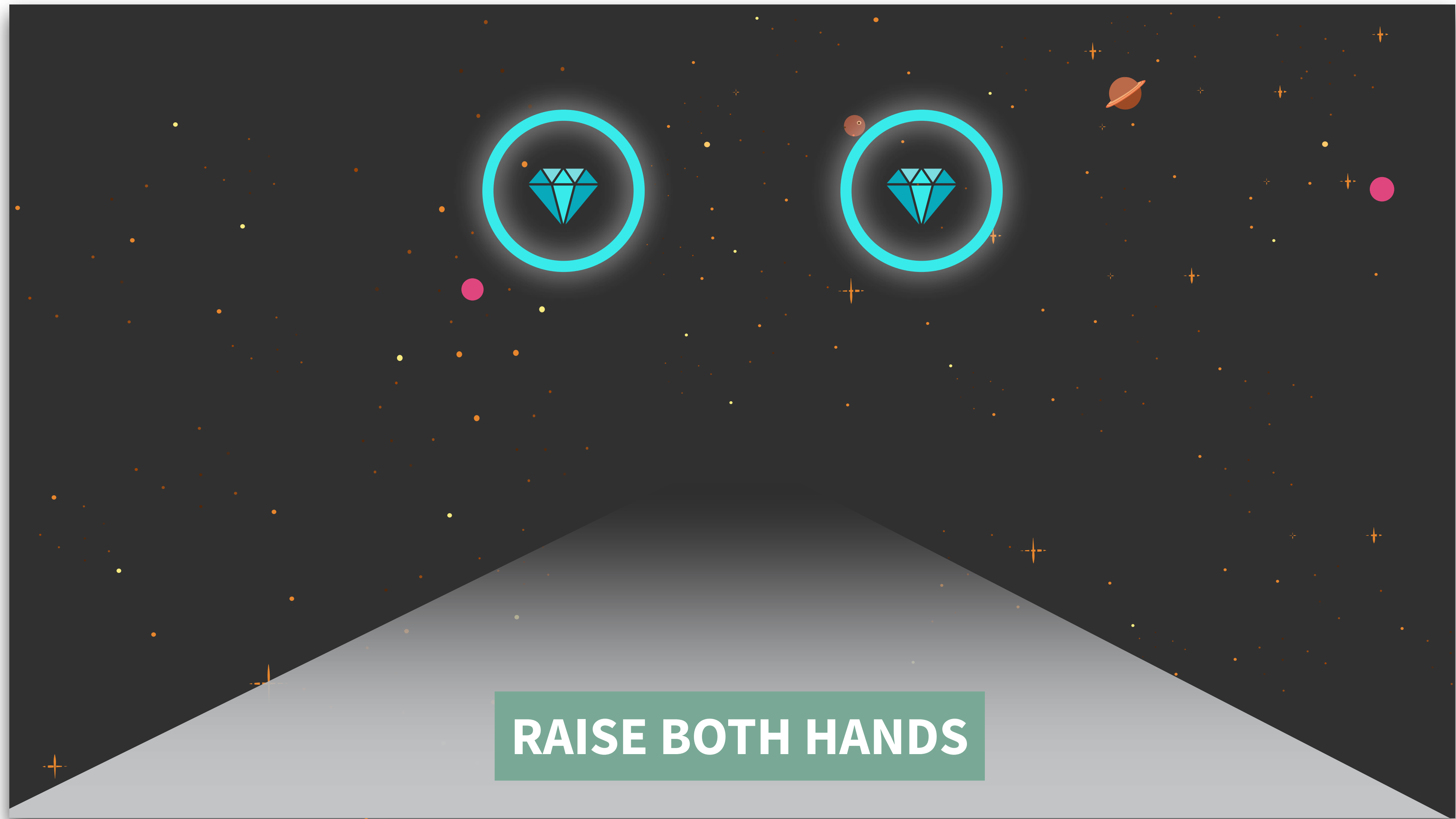




DODGE N EARN







RAISE BOTH HANDS



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

Right Shoulder Joint

Flexion

Max : 164

Avg : 141

90

180

0

Perfect Repetitions : 0

Exercise Time : 1:31 mins

Total Repetitions : 4

Type : Single Joint

Position : Standing

GIF

Speed

10

20

30

40

>

Repetitions

5

10

15

20

>

☐

add in left shoulder

Add

Update

Right Shoulder Joint

Abduction

Max : 164 Avg : 141

Single Joint

▼

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

All

Joint Combination

Single Joint

Standing

Quadruped

Lying down

GIF

GIF

GIF

Assign Exercises

Right Shoulder Joint

Flexion

Max : 171 Avg : 141

Single Joint

▼

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

GIF

GIF

GIF

Speed

10

20

30

40

>

Repetitions

5

10

15

20

>

☐

add in left shoulder

Assign Exercises

<

Patient Details

CHOOSE MODE

Auto

☐

Semi Auto

☐

Manual

☐


Next

Exercise Order

Report

<

Patient Details



CHOOSE UPDATE CYCLE

Weekly

☐

Bi-weekly

☐

Daily

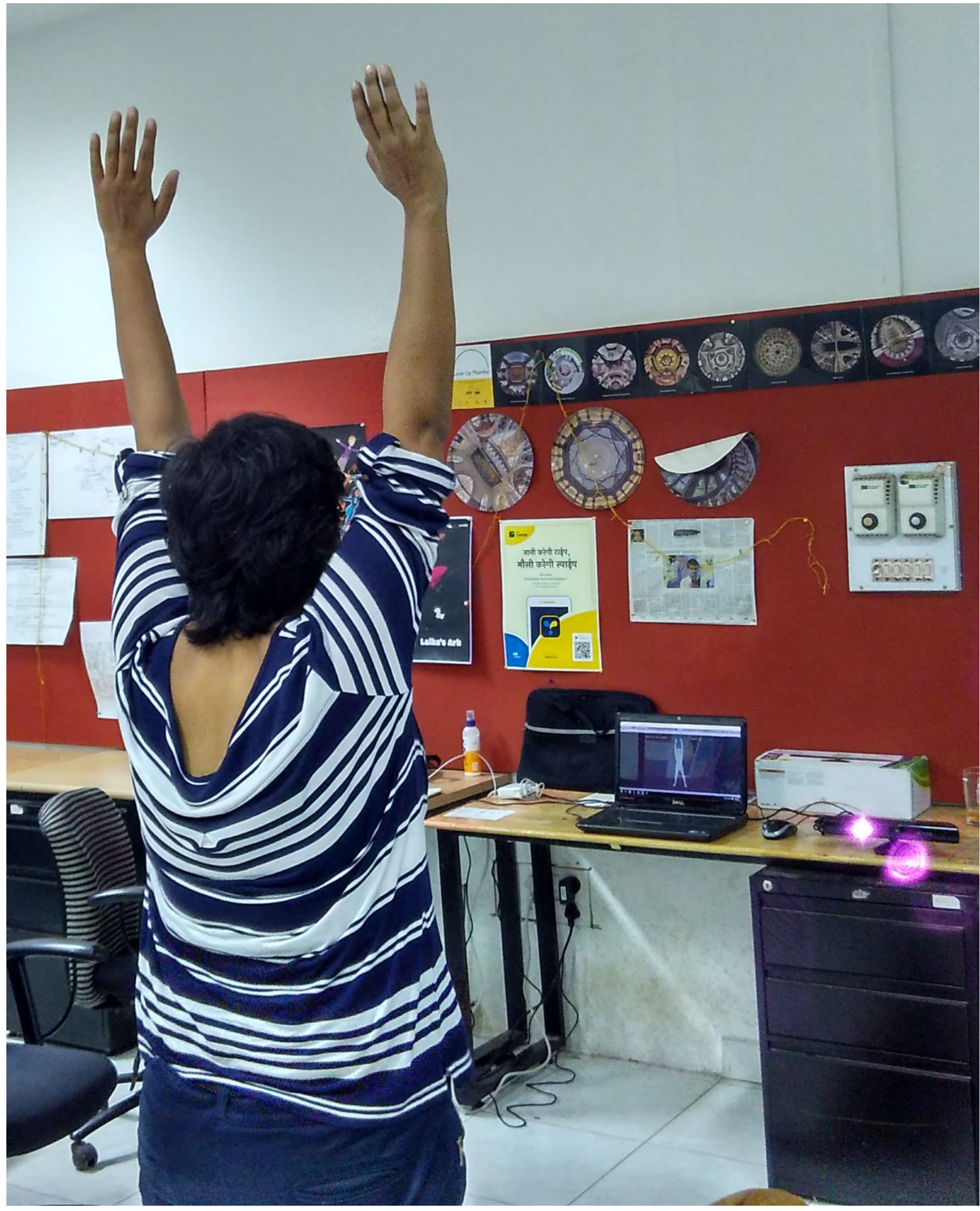
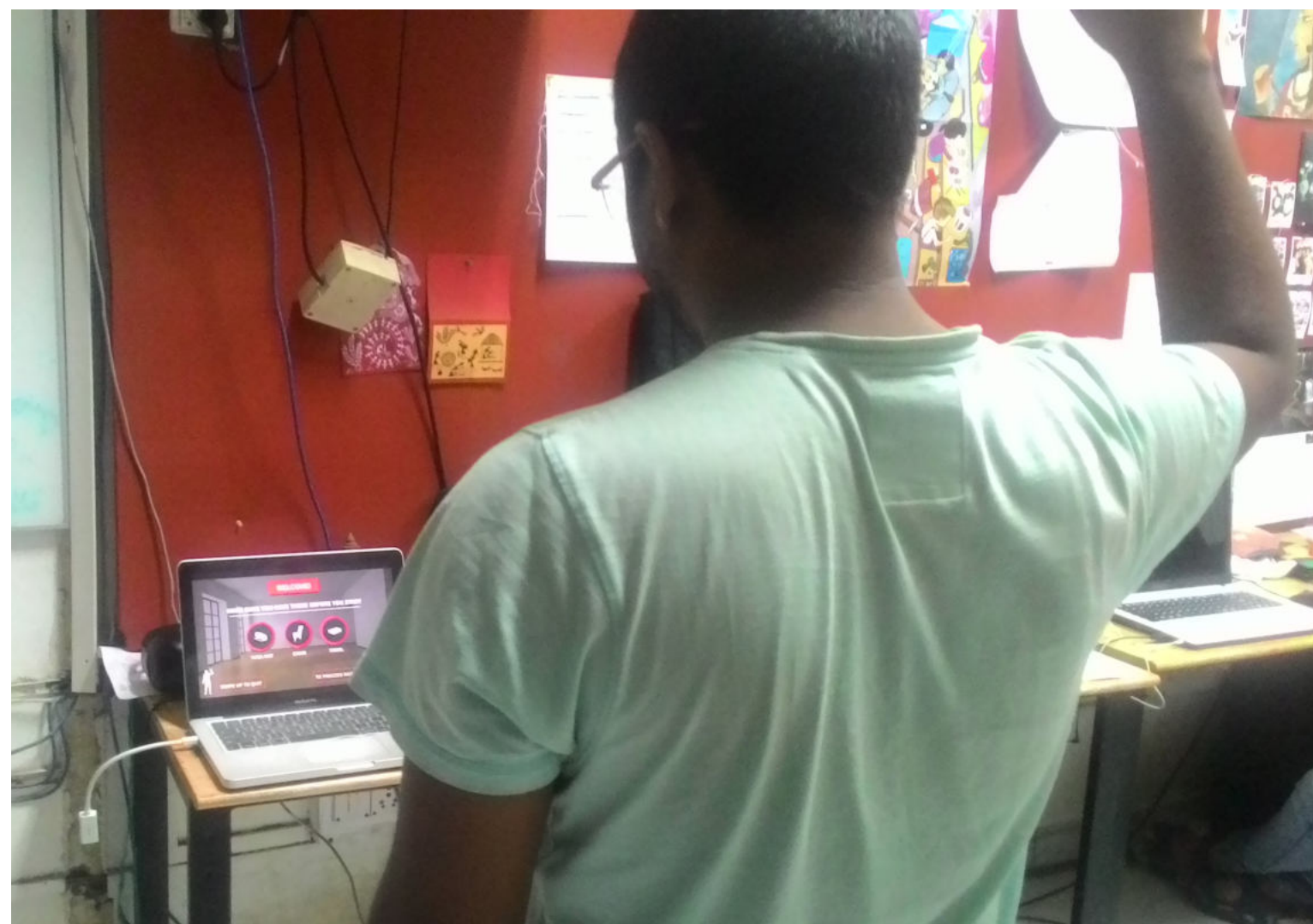
☐

Done

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

ACKNOWLEDGEMENTS

Dr. Sudha Srinivasan
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