AGILE SCIENCE | CREATE PHASE

VERSION 0.1

AS AGILE SCIENCE

AGILESCIENCE.ORG

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ACKNOWLEDGMENTS

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AGILE SCIENCE CREATE PHASE

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Overview

Agile Science's generate process helps behavioral scientists, industry partners, and human-computer interaction researchers and designers to specify, iteratively improve, and optimize intervention ideas.

This process works best when done with a group of people working on whiteboards. The most effective groups include people from different backgrounds who are trained in different fields, because variety in perspectives helps generate new ideas. That said, please feel free to complete this PDF on your own, as "worksheets," if you so prefer.

Also, please note that this is an iterative process. As such, although there is a suggested order, feel free to use whichever sheet you find most useful at any given point. With repeat use, the process will become familiar, and you can feel free to tweak it to your own working style.
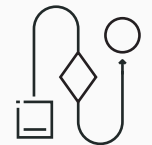
DURING THIS PROCESS, YOU WILL PRODUCE:

An overview of the prior work leading to your initial idea

A description of who might use your intervention at a specific time, in a specific place

A clearly articulated "hunch" about how your idea might influence a target outcome

A causal pathway mapping the steps by which your intervention influences a measurable proximal outcome

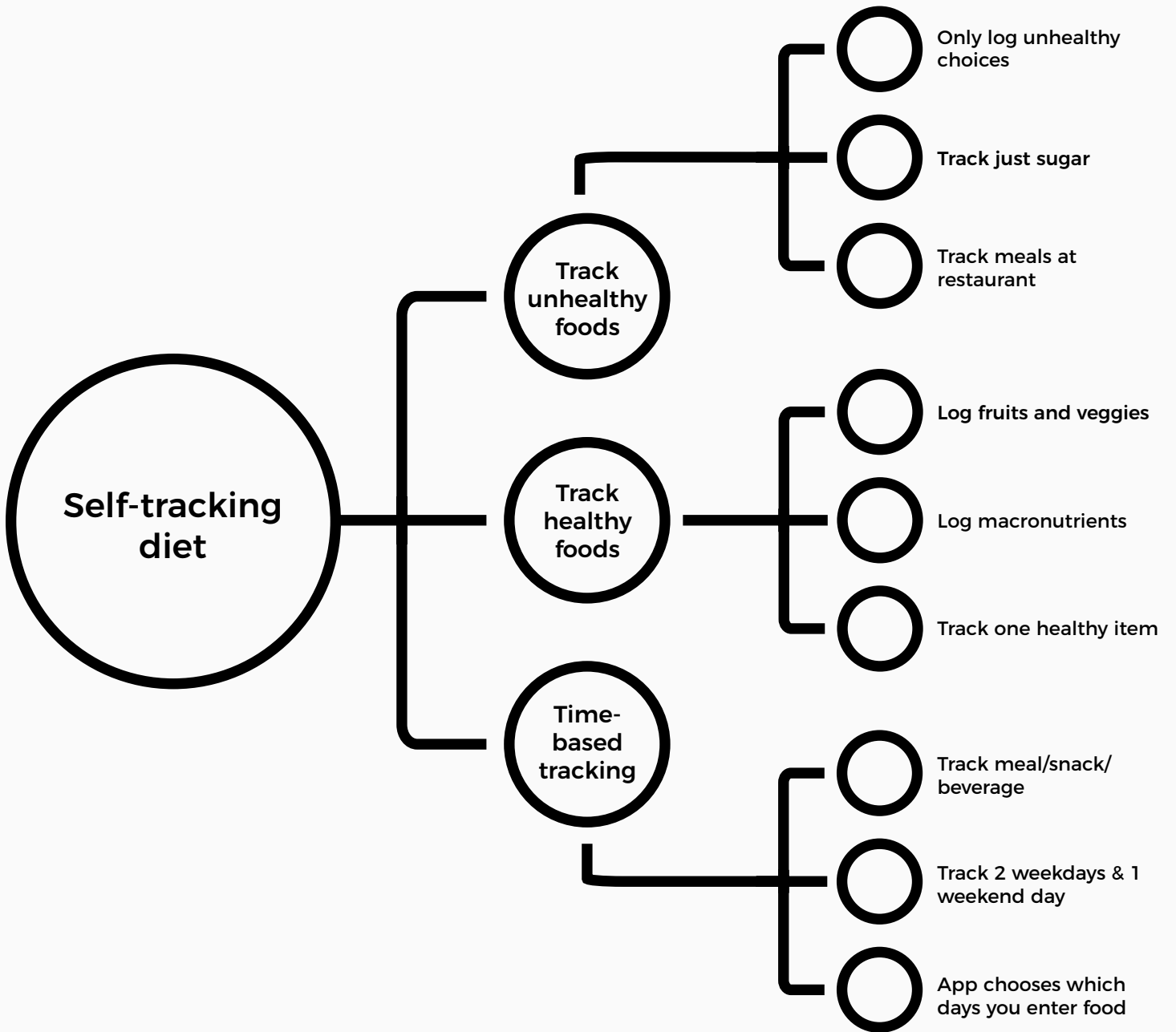A mind map of potential variations of your intervention idea

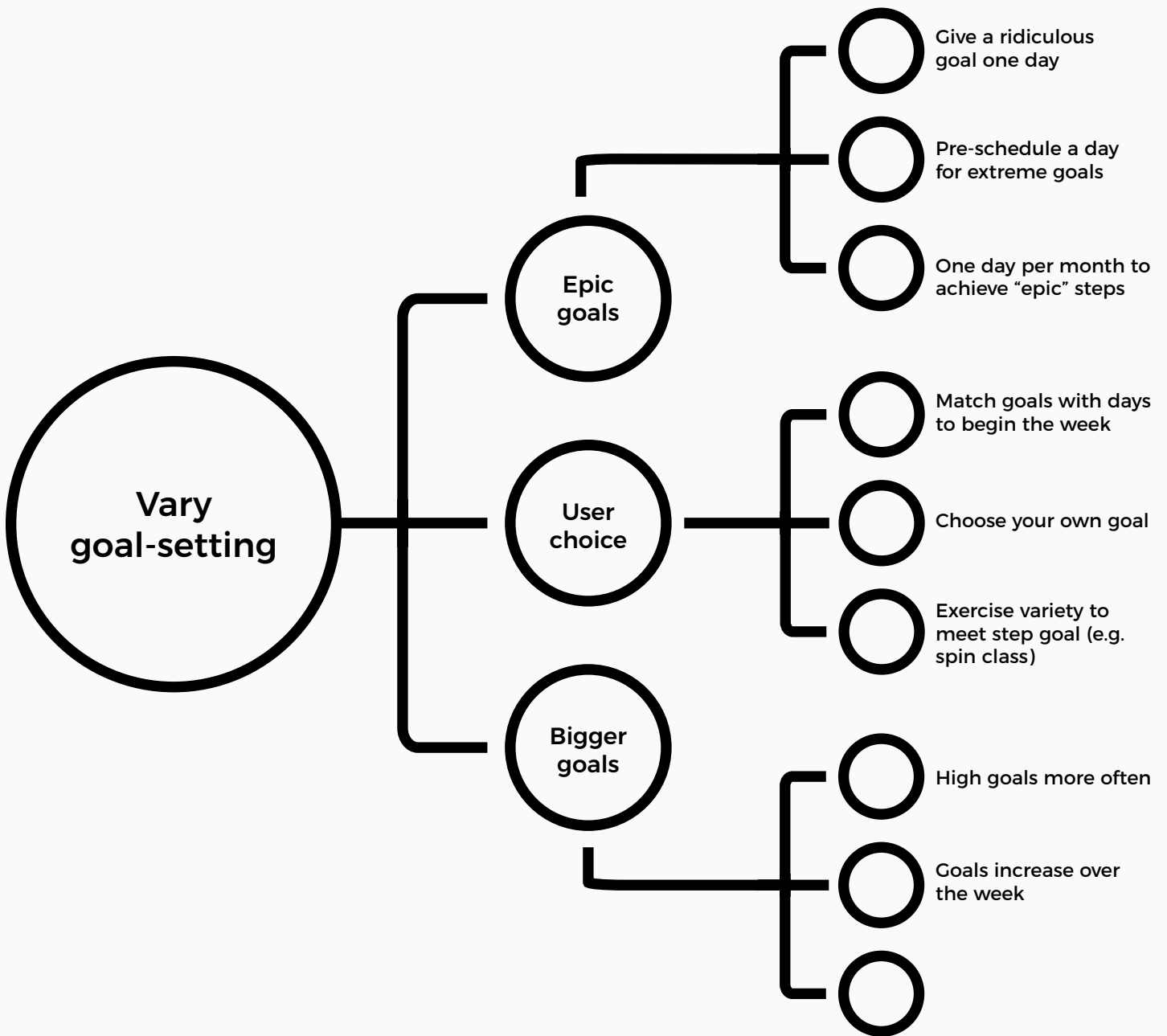A suite of potential prototypes for each variation

An experimental design to test prototypes against one another

All of the above will help you complete a diagram like the examples on the next two pages:

Diet example

```
                                                    ○  Only log unhealthy
                                                        choices

                                                    ○  Track just sugar

                           ○  Track
                              unhealthy            ○  Track meals at
                              foods                   restaurant

                                                    ○  Log fruits and veggies

○  Self-tracking          ○  Track                 ○  Log macronutrients
    diet                       healthy
                               foods
                                                    ○  Track one healthy item

                           ○  Time-
                              based                 ○  Track meal/snack/
                              tracking                 beverage

                                                    ○  Track 2 weekdays & 1
                                                        weekend day

                                                    ○  App chooses which
                                                        days you enter food
```

Steps example

Vary goal-setting

- **Epic goals**
  - Give a ridiculous goal one day
  - Pre-schedule a day for extreme goals
  - One day per month to achieve "epic" steps
- **User choice**
  - Match goals with days to begin the week
  - Choose your own goal
  - Exercise variety to meet step goal (e.g. spin class)
- **Bigger goals**
  - High goals more often
  - Goals increase over the week

INITIAL HUNCH:

To begin, let's get your initial hunch down on paper. On this first pass, just put something down and know that you'll come back to it. Most people using this process return to their hunch MANY times, and we suggest you consider revisiting (and potentially re-writing) it after each activity. Please fill in the following:

Based on theory, evidence, and understanding potential users, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

PRIOR WORK

What you need: An initial hunch for an intervention idea

What you'll do: Ground your hunch in prior work, drawing on theory, empirical evidence, and users

What you'll get: Literature review and empathy with users

THEORY OF CHANGE

If you have your own theory that explains how and why your hunch might produce change, please state it here:

EMPATHIZING WITH USERS

Who might use your intervention idea?

If possible, recruit a few plausible users for interviews and observation. We recommend IDEO's Design Kit if you are unfamiliar with methods for interviews and observation.

LITERATURE REVIEW

What fields might have engaged your hunch?

What do those literatures say about your hunch?

What relevant theories exist for your hunch?

What relevant, initial, empirical evidence exists for your hunch?

What methods might you use to investigate your hunch?

NICHE SPECIFICATION

What you need: A hunch about an intervention idea and a review of prior work

What you'll do: Define specifics about your potential users, and the context in which your intervention would be used

What you'll get: Specified users, time, and place for your intervention idea

Decisions specifying the who, what, where, and when of your intervention idea define the "niche" for your work.

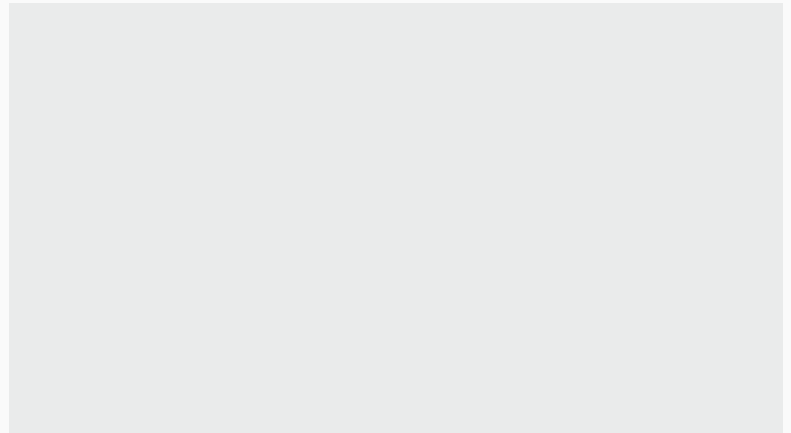As you move through this process, you will likely discover more about your niche.

As with all of these worksheets, feel free to return here to record any new specifics that emerge.
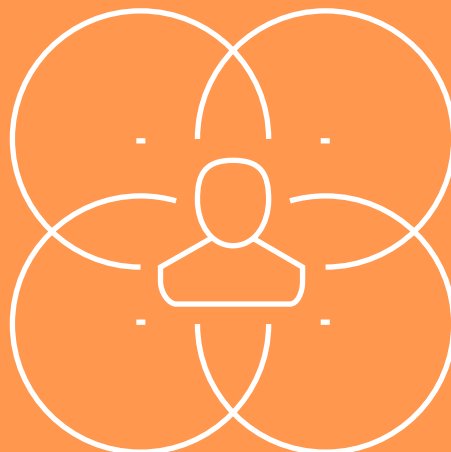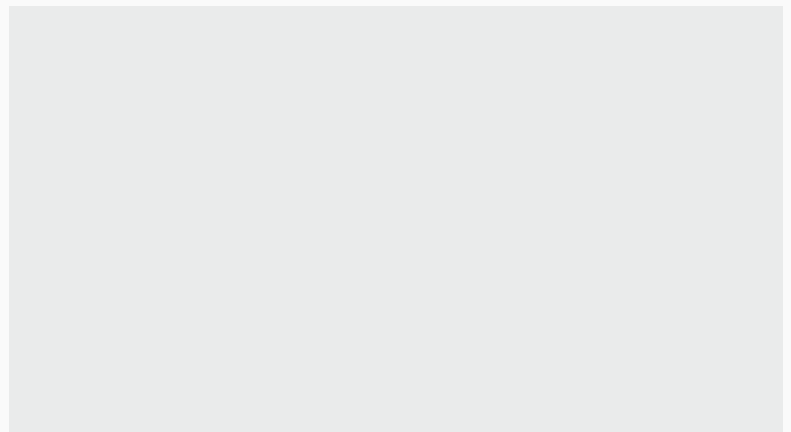
ACTIVITY

FOR WHOM ARE YOU DESIGNING?

Examples:

1) Overweight 30—60 year-olds willing to track diet with a smartphone app

2) Overweight, high income, sedentary, middle-aged adults with smartphones and a Fitbit

## FOR WHOM ARE YOU NOT DESIGNING?

Examples:

1) Adults in a weight loss program, tracking diet using a smartphone app, or taking weight loss pills; people not committed to measuring and logging food daily

2) Adults exercising >3 hrs/week, children, people with major health conditions, people unwilling to track or receive goals

WHEN AND WHERE WILL THIS INTERVENTION TAKE PLACE?
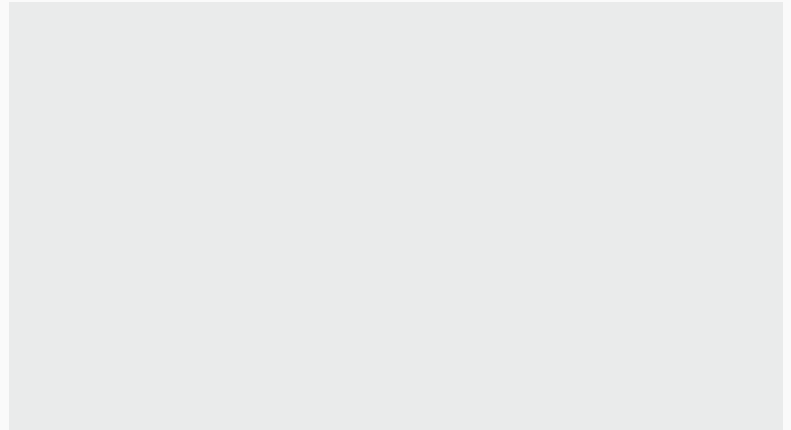
Examples:

1) Weight loss intervention in Seattle beginning in summer for 8 weeks

2) App-based intervention at a specific company planned over 4 weeks in spring/summer

---

If you are struggling with niche specification, or are inspired to add more detail, consider mapping the present complexity of your user and their environment. We recommend "Theory Mapping" and "Health Behavior Models" to help structure such mapping, in which you might consider:

What relevant actions do potentials users take?

What outcomes are driven by those actions?

What environmental factors are relevant?

What fields might have engaged your hunch?

HUNCH ARTICULATION

**What you need:** A hunch, prior work, and a specified niche

What you'll do: Revise the initial hunch based on initial evidence and niche specification

What you'll get: Revised hunch

Now that you have reviewed relevant literature, theory, empirical evidence, and user feedback, as well as specified the who, where, and when of your intervention idea, you should be ready to articulate a revised hunch on the next page. We have provided examples here, and more blank hunch statements on the following pages, for you to fill in as your hunch becomes more specified:

Examples

1. Based on prior work, I'm not sure, but I think that tracking diet with MyFitnessPal will influence people's food awareness and result in weight loss

2. Based on prior work, I'm not sure, but I think that variability in daily step-goals will influence walking behaviors
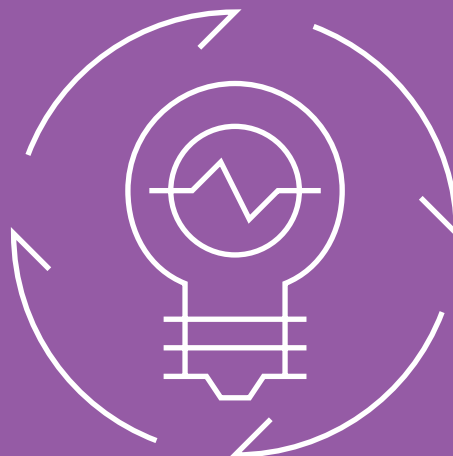
Revised hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

Post causal pathway hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

Post mind mapping hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

Hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

Hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

Hunch:

Based on prior work, I'm not sure, but I think that

(Fill in your intervention idea)

will influence

(Fill in your outcome)

CAUSAL PATHWAY MAPPING

What you need: A well-formulated hunch, prior work, and a specific niche

What you'll do: Visually map the causal pathway through which your intervention idea influences a proximal outcome

What you'll get: Causal pathway map

Interventions are often designed to help individuals achieve a desired outcome, such as a regular pattern of physical activity or weight loss.

These are distal outcomes, and to achieve them, an intervention usually has components. The direct outcomes of individual components are proximal outcomes.

Proximal outcomes are the measurable changes in behavior that make up the steps in the path from an intervention to distal outcome(s).

Legend

A causal pathway visualizes how you think your intervention causes the effects you are interested in producing. It shows the cause and effect chain(s) that link your intervention idea with proximal and distal behavioral outcome(s).

The goal of this exercise is to help you think clearly through exactly how your intervention idea will impact your proximal outcome(s) and, if relevant, more distal outcomes. Here is the legend you will use in your map:

Legend

□ **Intervention components:**
what your system does

○ **Outcome(s):**
changes in an individual's behavior

○ **Niche:**
characteristics of intervention recipients
and the context in which it will take place.

◇ **Decisions:**
interactions predicated on previous
actions, outcomes, or niche characteristics

Diet example

Before you map the causal pathway for your intervention idea, let's walk through a couple examples. The first example begins with this hunch:
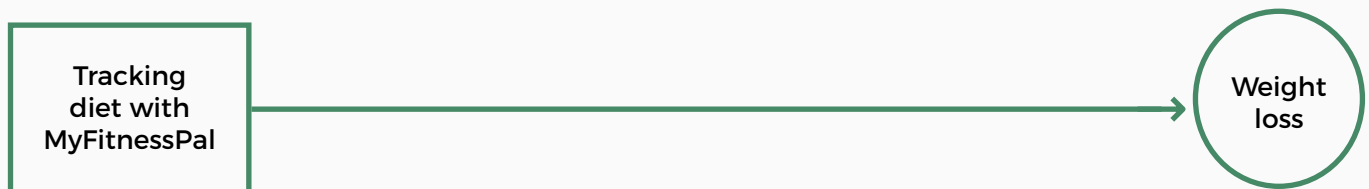
I'm not sure, but I think that

diet tracking with MyFitnessPal
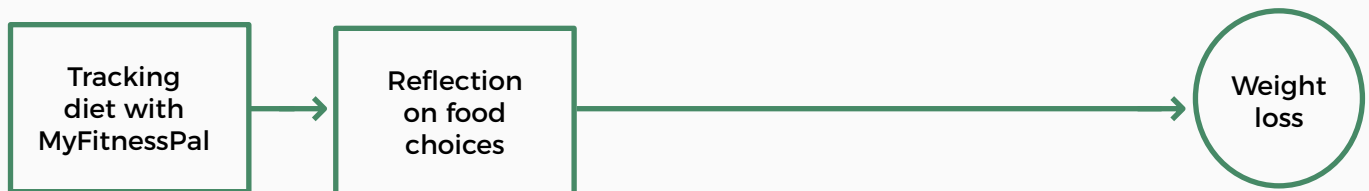
(Fill in your intervention idea)

will influence

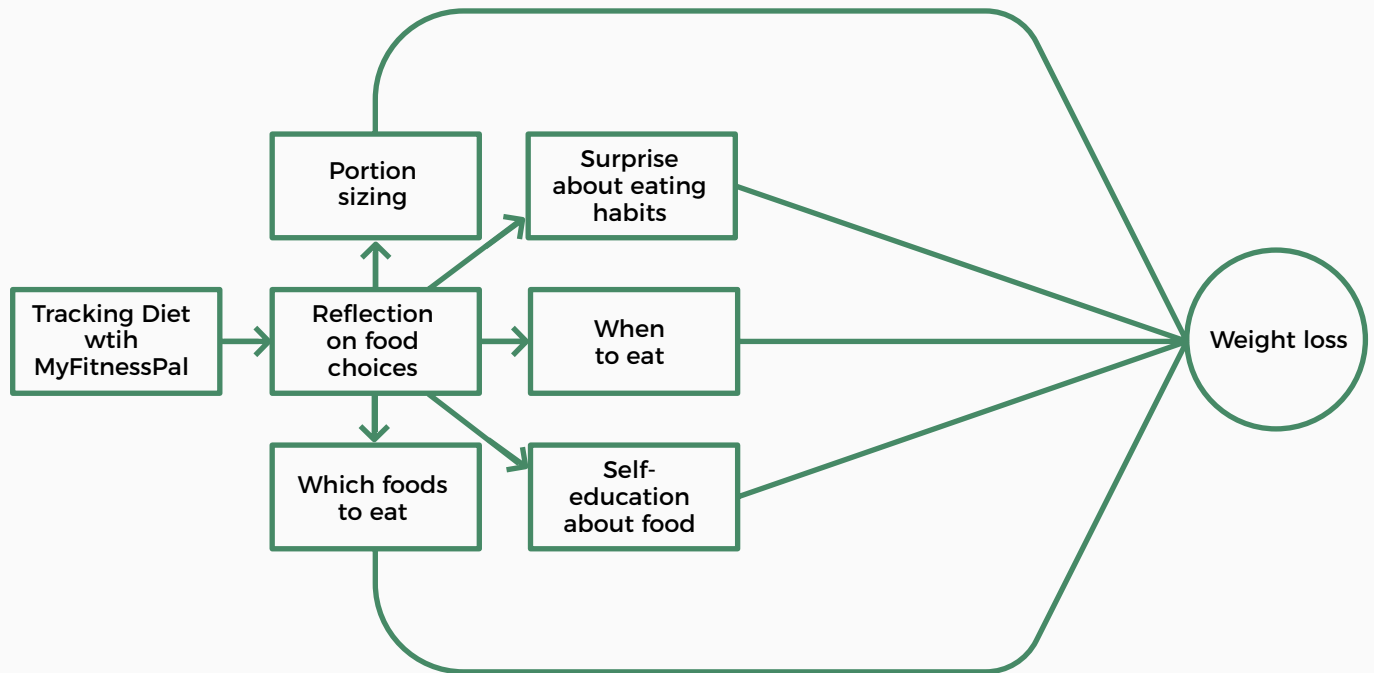**weight loss**

(Fill in your outcome)

Now, consider the intermediary steps required for diet tracking with MyFitnessPal to create measurable change in weight. One well established impact of self-tracking diet is reflection on food choices.

However, there are numerous reflections about food choices that diet tracking might influence. To generate reflections that might be of interest, let's map a variety.
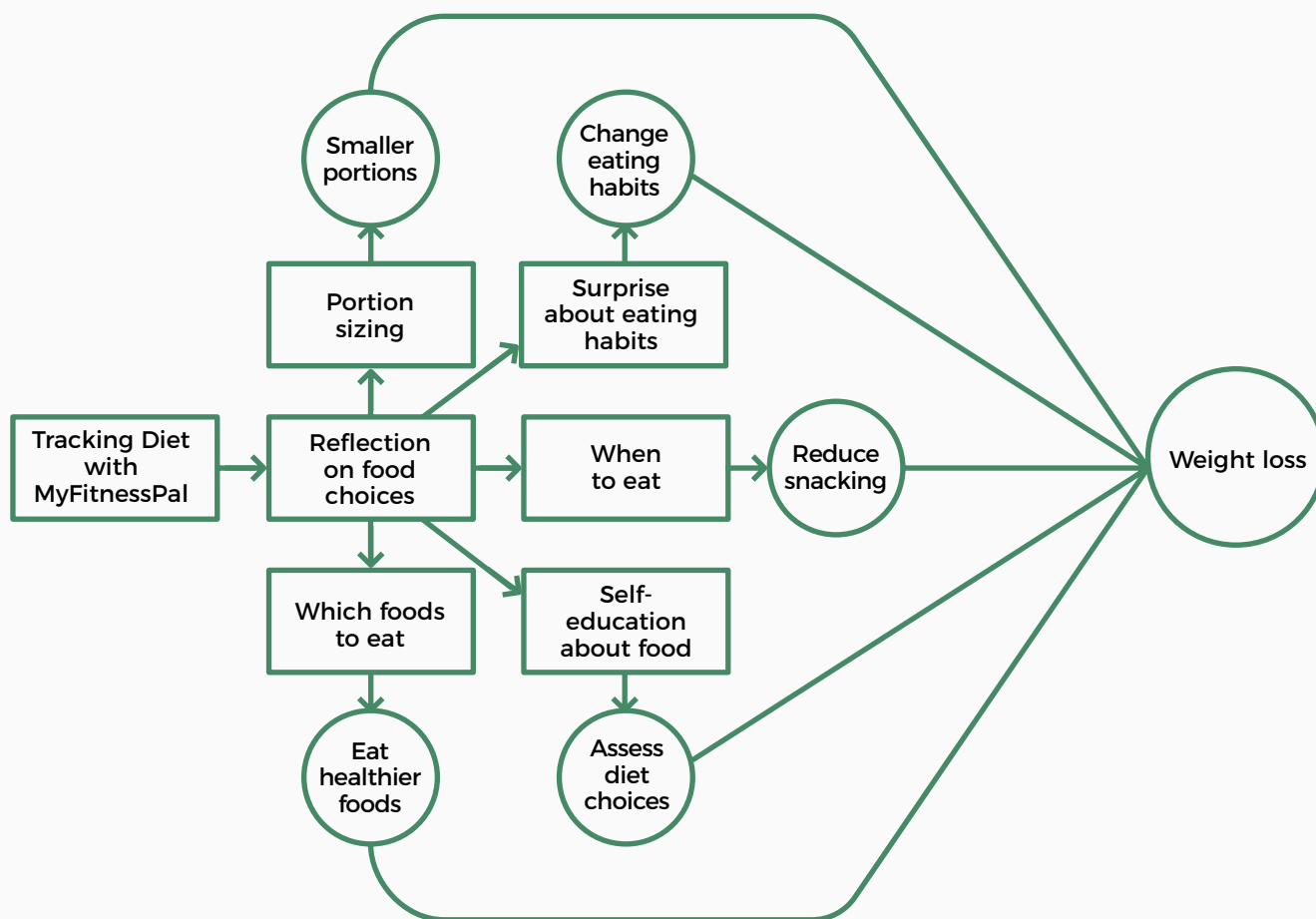
Diet example

Unfortunately, reflections alone do not result in weight loss.
Actions based on those reflections are another intermediary step,
so let's map actions that specific reflections could inspire. These
actions are proximal outcomes that could lead to the distal
outcome of weight loss.

Diet example

This causal map shows that weight loss is linked to tracking diet with My-FitnessPal indirectly, with its impact potentially contingent on one of a variety of causal chains, for example:

Tracking diet leading the user to reflect on food choices ⟶ Reflection on food choices including portion sizes ⟶ New awareness of portion sizes leading the user to eat smaller portions ⟶ Eating smaller portions leads to weight loss

The proximal outcomes above could be the behavioral outcome(s) of interest for an intervention idea with a shorter causal pathway than "weight loss" provides. This process of causal pathway mapping will allow you to identify proximal behavioral outcomes of interest, and generate an intervention idea that directly influences those outcomes.

Steps example

Our second example begins with this hunch:

Based on initial evidence, I'm not sure, but I think that

> **varying step goals**
>
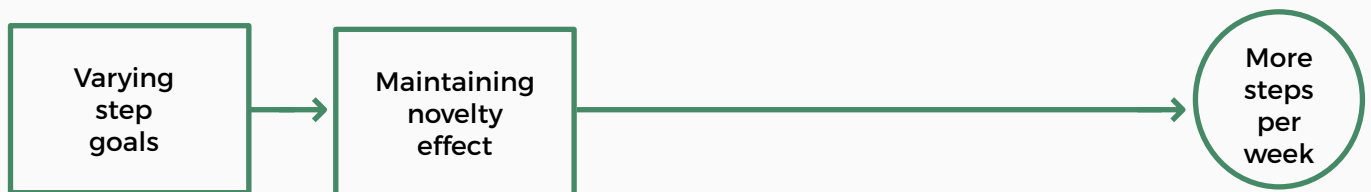> *(Fill in your intervention idea)*

will influence

> **walking behaviors**
>
> *(Fill in your outcome)*
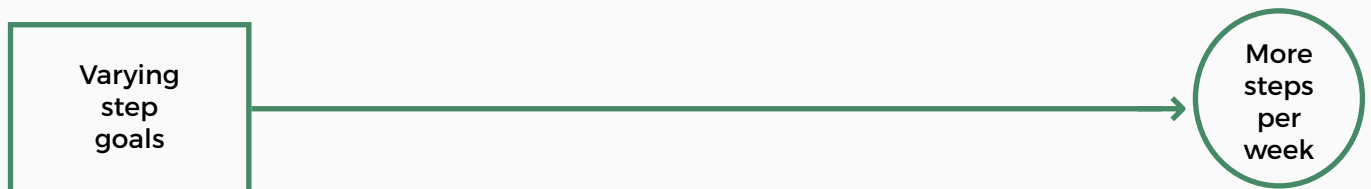
Now, consider the intermediary steps required for varying step goals to create measurable change in steps per week. It is plausible that varying step goals will maintain novelty, particularly when they are "ambitious."

However, there are other ways that novelty could impact weekly step volume:

Steps example

```
                    ┌──────────────┐
                    │  Enjoy the   │
                    │  challenge   │
                    └──────────────┘
```
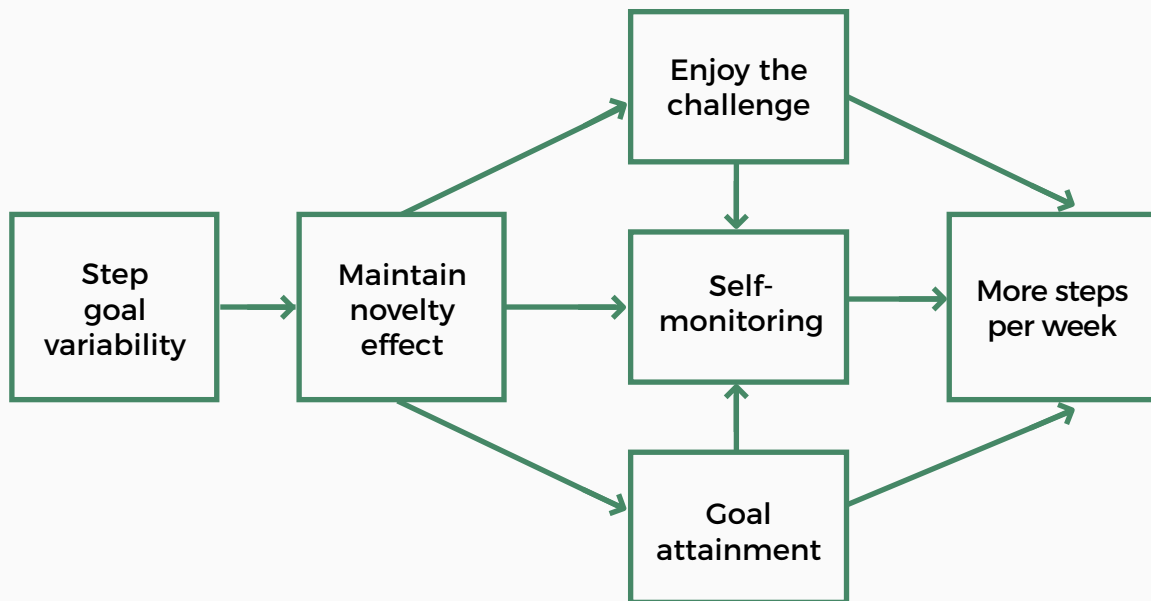

Unfortunately, novelty alone does not result in increased steps per day. Actions based on the results of novelty are another intermediary step, so let's map those actions. The new actions below are proximal outcomes that could lead to the distal outcome of more steps per week.

Steps example

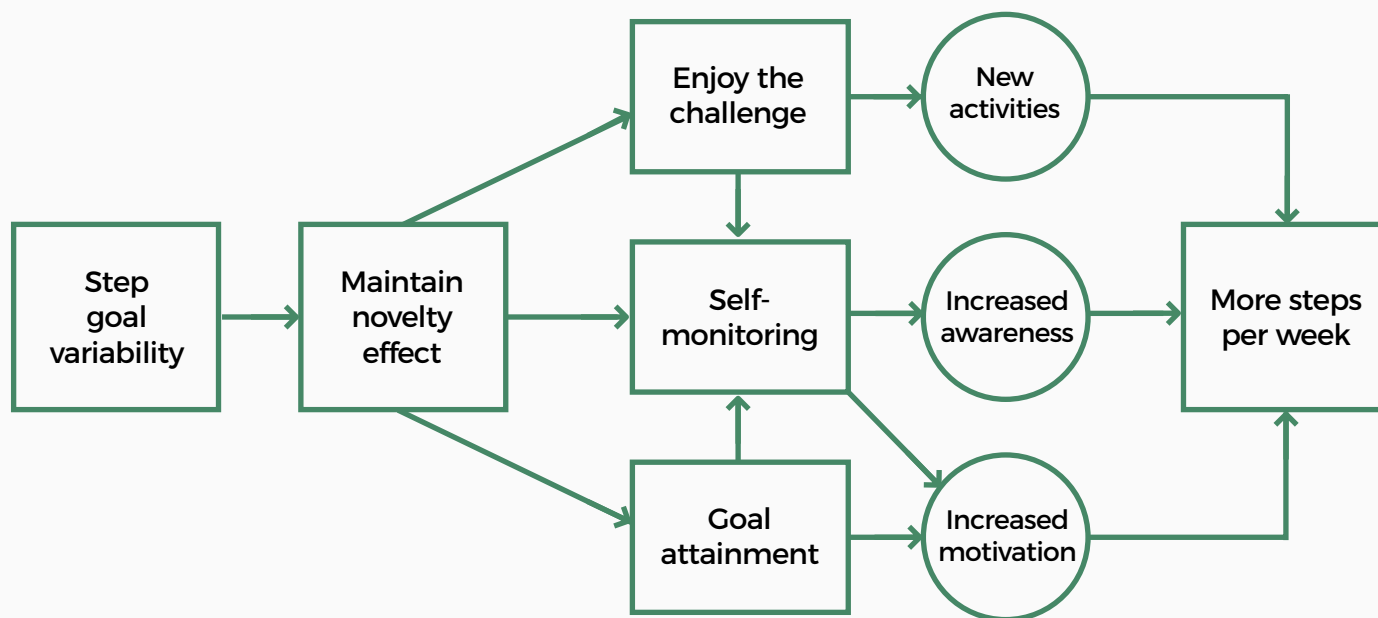Having completed this causal map, we again see that increased steps is linked to varying step goals indirectly, with its impact potentially contingent on one of a variety of causal chains, for example:

Step goal variability maintaining novelty ➞
Novelty driving ongoing self-monitoring ➞
Self-monitoring creating motivation to achieve more daily step goals ➞
Achievement of physical activity guidelines

As in our first example, the above are proximal outcomes, which could be the behavioral outcome(s) of interest for an intervention idea with a shorter causal pathway than "more steps per week" provides.

ACTIVITY

Now that you've seen these examples, it's time for you to map the causal pathway of your intervention idea. To begin, write your intervention idea in a box on the left side of a whiteboard (or on this page), and the behavioral outcome of interest in a circle on the right side. Then, use the legend to sketch out your causal map, using our examples as guides.

Legend

Intervention components:
what your system does

Outcome(s):
changes in an individual's behavior

Niche:
characteristics of intervention recipients
and the context in which it will take place.

Decisions:
interactions predicated on previous
actions, outcomes, or niche characteristics

Diet Example

When you have a causal map with which you are satisfied, choose a proximal outcome of interest, and articulate a more specific intervention idea (that will probably be longer), which would produce measurable change in that behavioral outcome. Then, return to page 15 in the hunch section to plug those elements into the causal pathway hunch statement.

With a better specified hunch, it will be easier to create a detailed causal pathway map for your intervention idea. This subsequent map is more likely to include if/then decision diamonds. See the example below:

If no logs in 24 hrs, users receive reminder

Tracking portion sizes → Download app → Search meal ingredients → Picture of recommended portion → Eating smaller portions
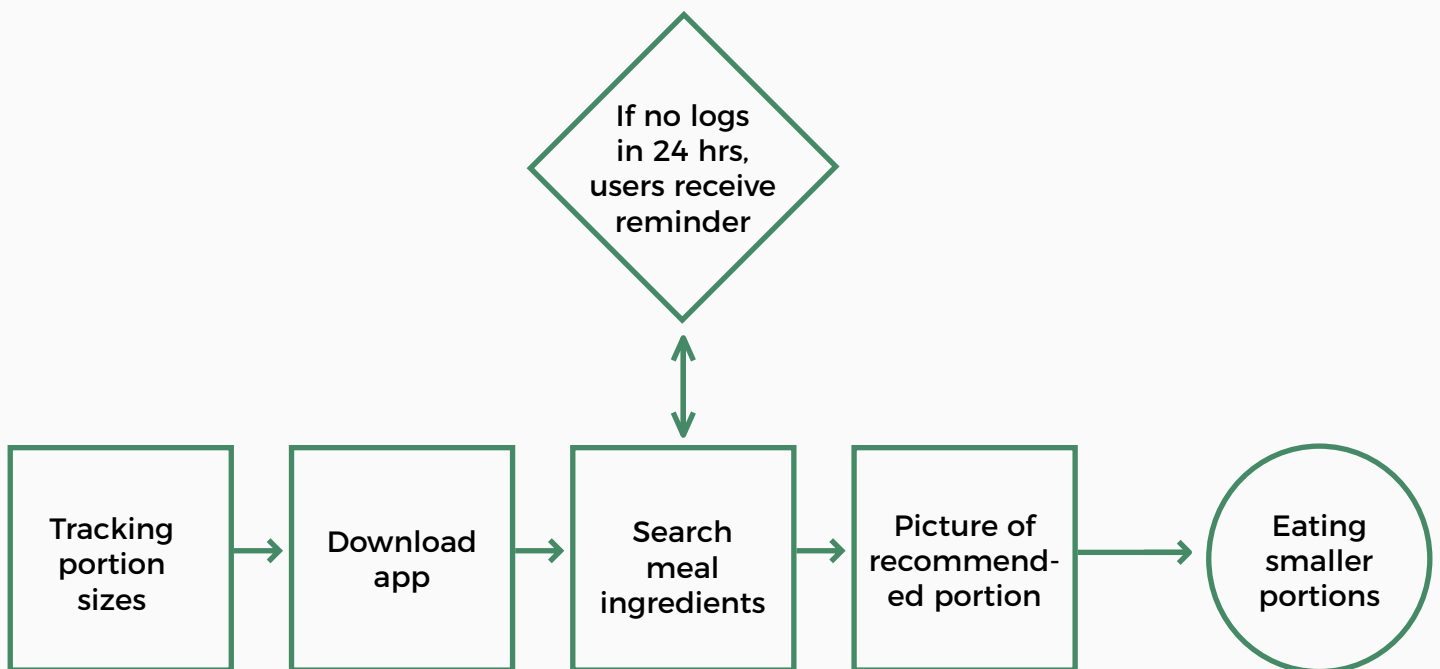
After you have mapped a causal pathway for your revised hunch, it's time for you to generate a mind map.

MIND MAPPING

What you need: A hunch about an intervention affecting a proximal oucome, and a causal map of how it might work.

What you'll do: Brainstorm about your intervention idea on post-it notes, group them, and narrow the groups to 3—5 contender variations of your intervention idea.

What you'll get: Ideas related to your hunch and intervention idea, grouped into potential variations of the intervention idea.

Okay, this is the exciting part! In this exercise, you will brainstorm about your intervention idea. We recommend reviewing the brainstorming section of IDEO's Design Kit before you begin.

This is the most important part of the process to do with a group, so we recommend getting a diverse set of people together. To get a sense for how this will work, glance through the examples on the next few pages.

Diet example

How might we get individuals to make healthier food choices through self-tracking diet with an app, such as MyFitnessPal?

Log fruits & veggies

Only log unhealthy choices

Photograph meals and snacks

Log mac-ronutrients (protein, carb, fats)

Log with a calorie database

Log food (but not cals) in a journal or diary

Use red/ yellow/ green light system

Track one healthy item (green veggies, legumes, protein)

Log categories (veggies, grains, dessert)

Track just sugar

Track as a family

Track meals at restaurants

App chooses which days you enter food

Focus on portion sizes

Track meal/ snack/ beverage

Track 2 weekdays & 1 week-end day

Track only processed food

Diet example

| Track unhealthy foods	Track healthy foods	Time-based tracking	Log without counting calories
Only log unhealthy choices	Log fruits & veggies	Track meal/snack/beverage	Use red/yellow/green light system
Track just sugar	Log macronutrients	Track 2 weekdays & 1 weekend day	Photograph meals and snacks
Track meals at restaurant	Track one healthy item	App chooses which days you enter food	Log food (but not cals) in a journal or diary
Track only processed food	Log with a calorie database		Focus on portion sizes
			Log categories

Other: Track as a family

Diet example
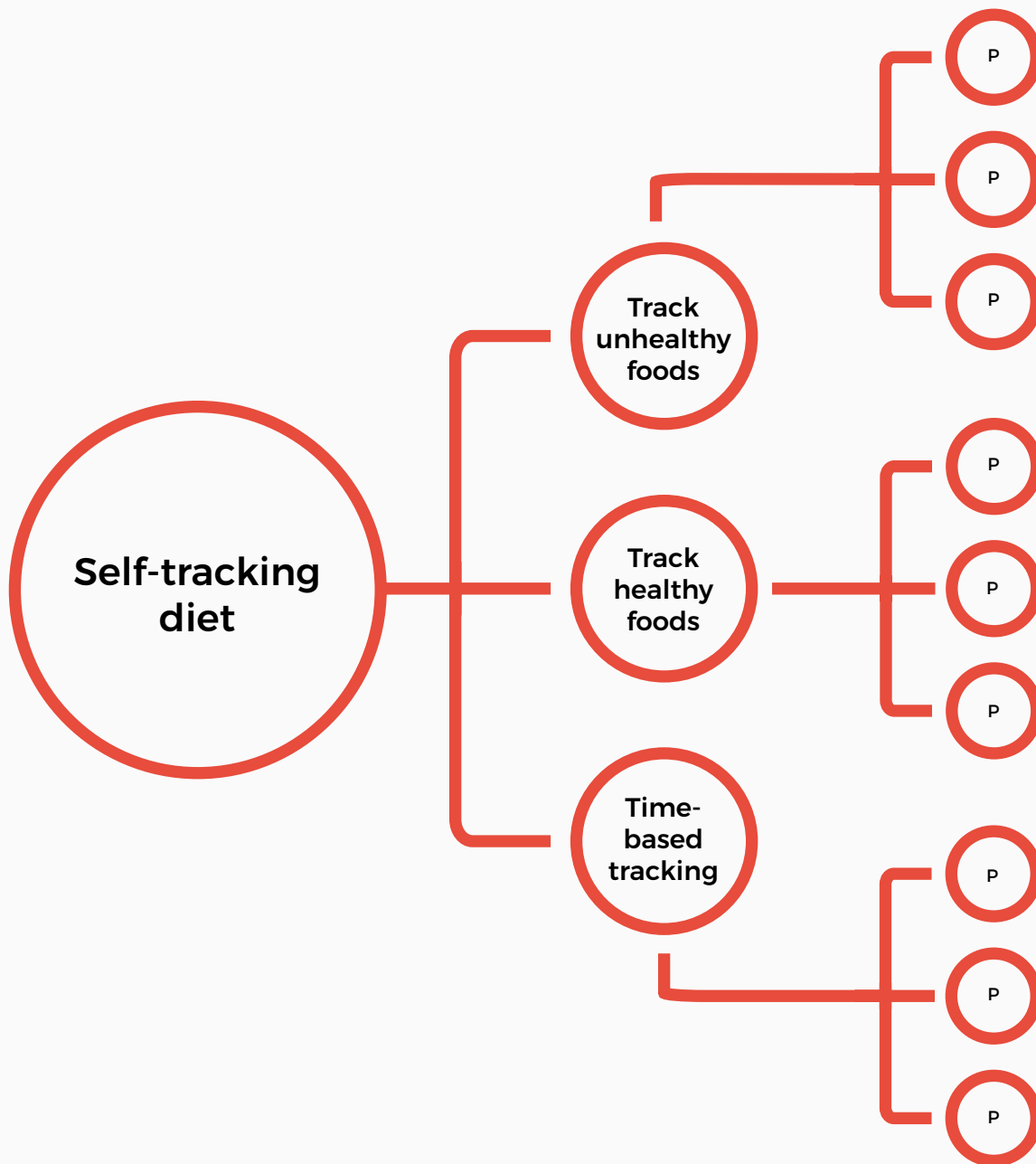
Steps example

How might we vary goal-setting for steps walked in a day?

High goals more often

Occasional extremely high goals

Pre-schedule a day for extreme goals

Goals increase over the week

Choose your own goal

Schedule goals (H, H, H, L, or HH, LL, HH)

"Surprise" days of rest

Contextual goals (lower on busy days)

Allow "get out of step goal" days

Exercise variety to meet step goal (e.g. spin class)

Reduce next goal to median after missed goals

Give a ridiculous goal one day

One day per month to achieve "epic" steps

Match goals with days to begin the week

Diet example

| Epic goals	User choice	Bigger goals	Rest
Give a ridiculous goal one day	Match goals with days to begin the week	High goals more often	Allow "get out of step goal" days each cycle
Pre-schedule a day for extreme goals	Choose your own goal	Goals increase over the week	"Surprise" days of rest
One day per month to achieve "epic" steps	Exercise variety to meet step goal (e.g. spin class)		Reduce next goal to median after missed goals
Occasional extremely high goals			Contextual goals (lower on busy days)

Other: Schedule goals

Steps example
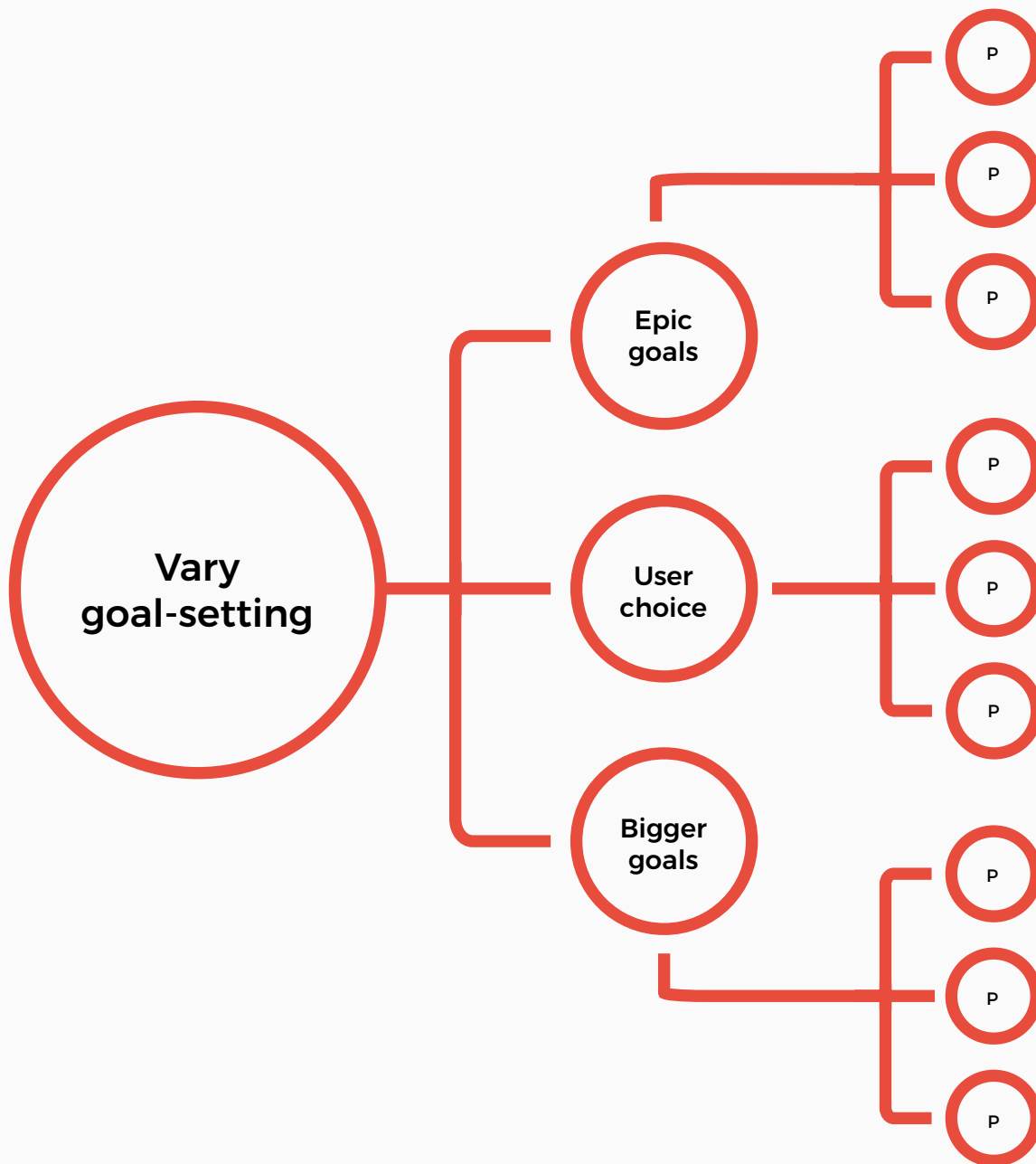
After you have reviewed the examples, it's time to create the same diagram for your intervention idea, using these steps:

1. Review the basic rules of brainstorming from the [Design Kit](#).
2. Write a "How might we…" question on a whiteboard to guide and frame the brainstorm.
3. Do 5—7 minutes of silent, parallel individual thinking, writing each idea on a separate post-it note. This is specific to this process, so you won't see it in the Design Kit instructions.
4. After the solo exercise, begin the brainstorming exercise as described in the Design Kit.
5. After creating lots of ideas, begin "bundling" ideas by sticking all the post-its to the whiteboard and grouping similar things.

The labels you choose for these bundles will be "variations" of your intervention idea. Once you have identified bundles, filter to 3—5, based on criteria of:

1. Your interest/excitement in each group
2. Feasibility of building intervention(s) for each group
3. Confidence that the ideas in a group would affect the proximal outcome

At this point, it's common for people to find themselves interested in a new or slightly different idea. If that's your experience, feel free to go back to page 16 in the hunch section and fill in the mind mapping hunch statement. You can also revisit any other prior activities, as this is a highly iterative process. If you're feeling ready to move into prototype generation, use your most current hunch to fill in the diagram on the next page.
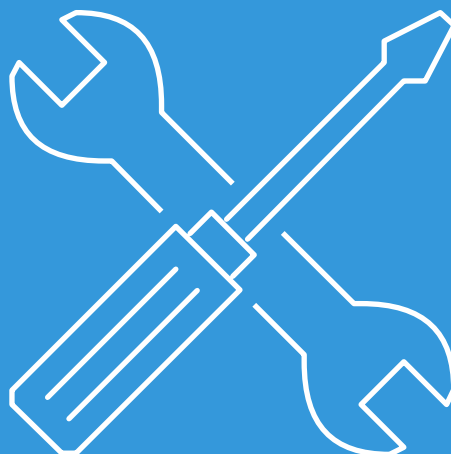
ACTIVITY
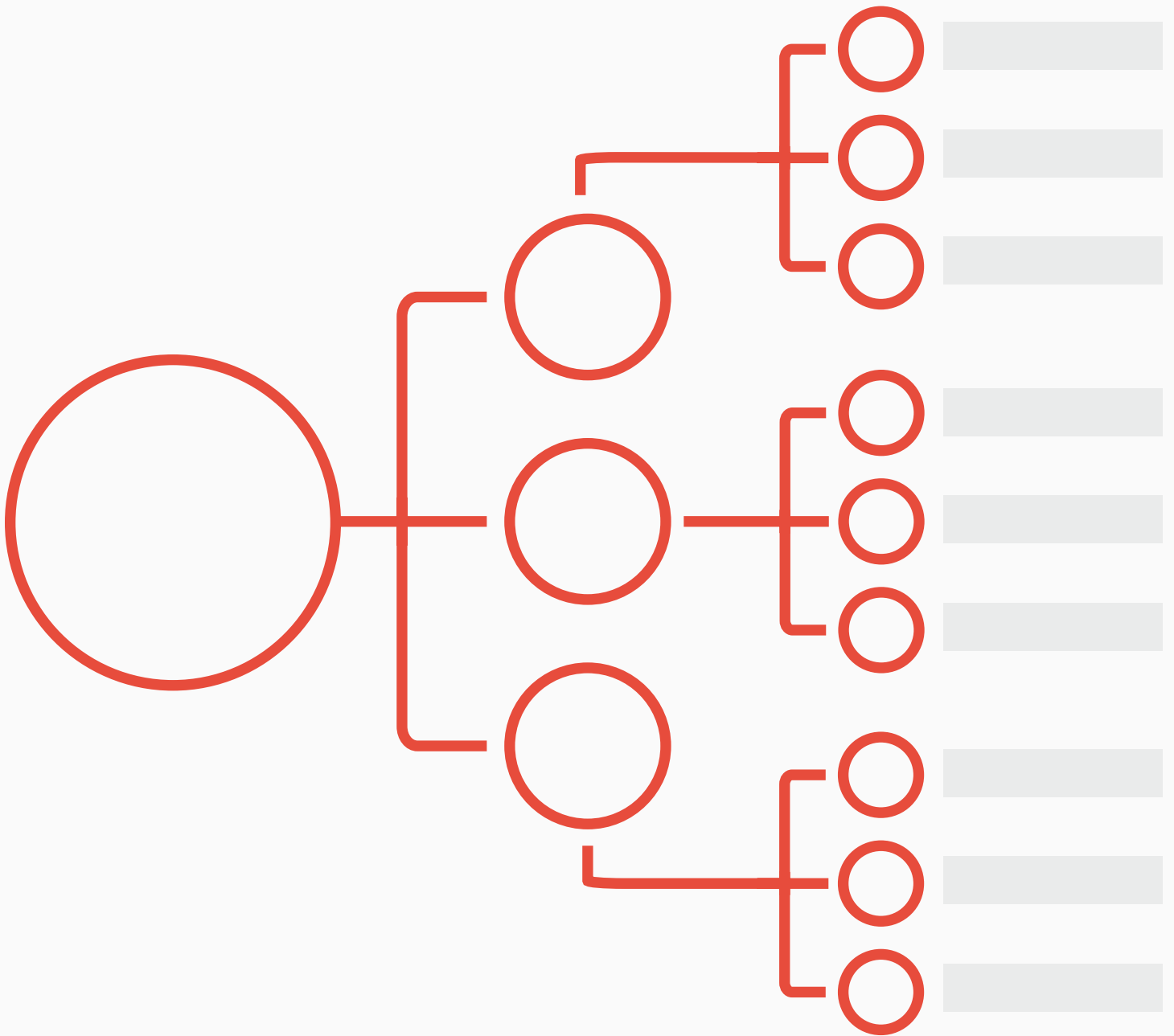
PROTOTYPE GENERATION

What you need: Intervention idea variations and the concrete examples on post-it notes from the brainstorming work.

What you'll do: Apply criteria within the variations.

What you'll get: Selection of prototypes to test.

At this point, many of the ideas within your variations will likely be potential prototypes that you could build. There are many prototyping resources to assist you in that process, and we again recommend consulting IDEO's Design Kit, as it contains excellent prototyping resources.

However, you likely will be constrained by time and resources to only prototyping some of the ideas you have generated. Take a look at the examples on the next couple pages, then discuss the suggested criteria for selecting which prototypes to build and test against one another.

Diet example

```
                                                    ○  Only log unhealthy
                                                       choices

                                          ○  Track    ○  Track just sugar
                                             unhealthy
                                             foods     ○  Track meals at
                                                          restaurant


                                                    ○  Log fruits and veggies

   ○  Self-tracking              ○  Track healthy   ○  Log macronutrients
      diet                          foods
                                                    ○  Track one healthy item


                                                    ○  Track meal/snack/
                                          ○  Time-      beverage
                                             based
                                             tracking  ○  Track 2 weekdays & 1
                                                          weekend day

                                                    ○  App chooses which
                                                       days you enter food
```
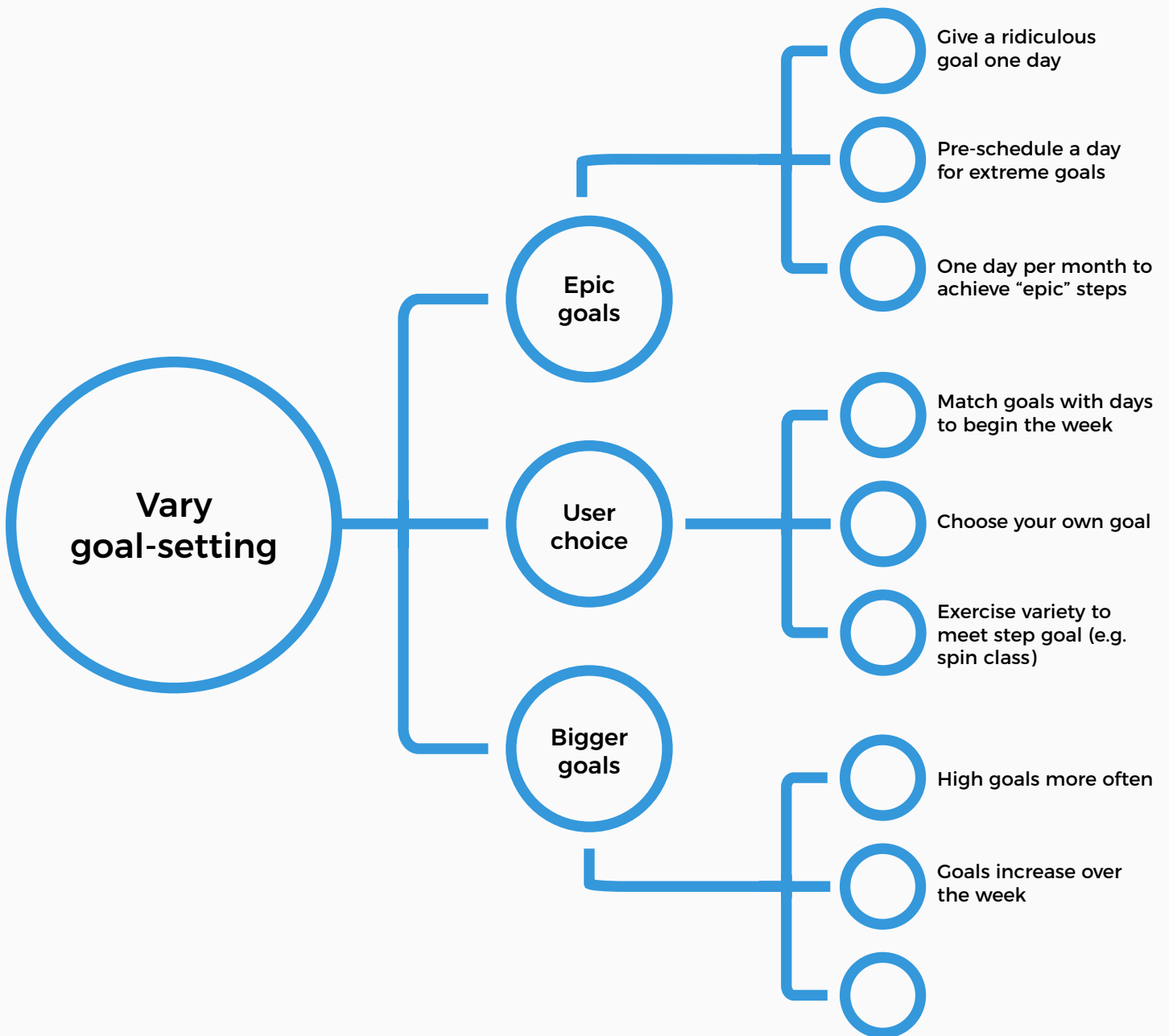
Steps example

```
Vary goal-setting
├── Epic goals
│   ├── Give a ridiculous goal one day
│   ├── Pre-schedule a day for extreme goals
│   └── One day per month to achieve "epic" steps
├── User choice
│   ├── Match goals with days to begin the week
│   ├── Choose your own goal
│   └── Exercise variety to meet step goal (e.g. spin class)
└── Bigger goals
    ├── High goals more often
    ├── Goals increase over the week
    └──
```

To choose which potential prototypes of your variations to build, discuss the following:

How interested/excited are you about each group?

How likely is each prototype to influence your proximal outcome?

What skills would be required to build and implement each prototype?
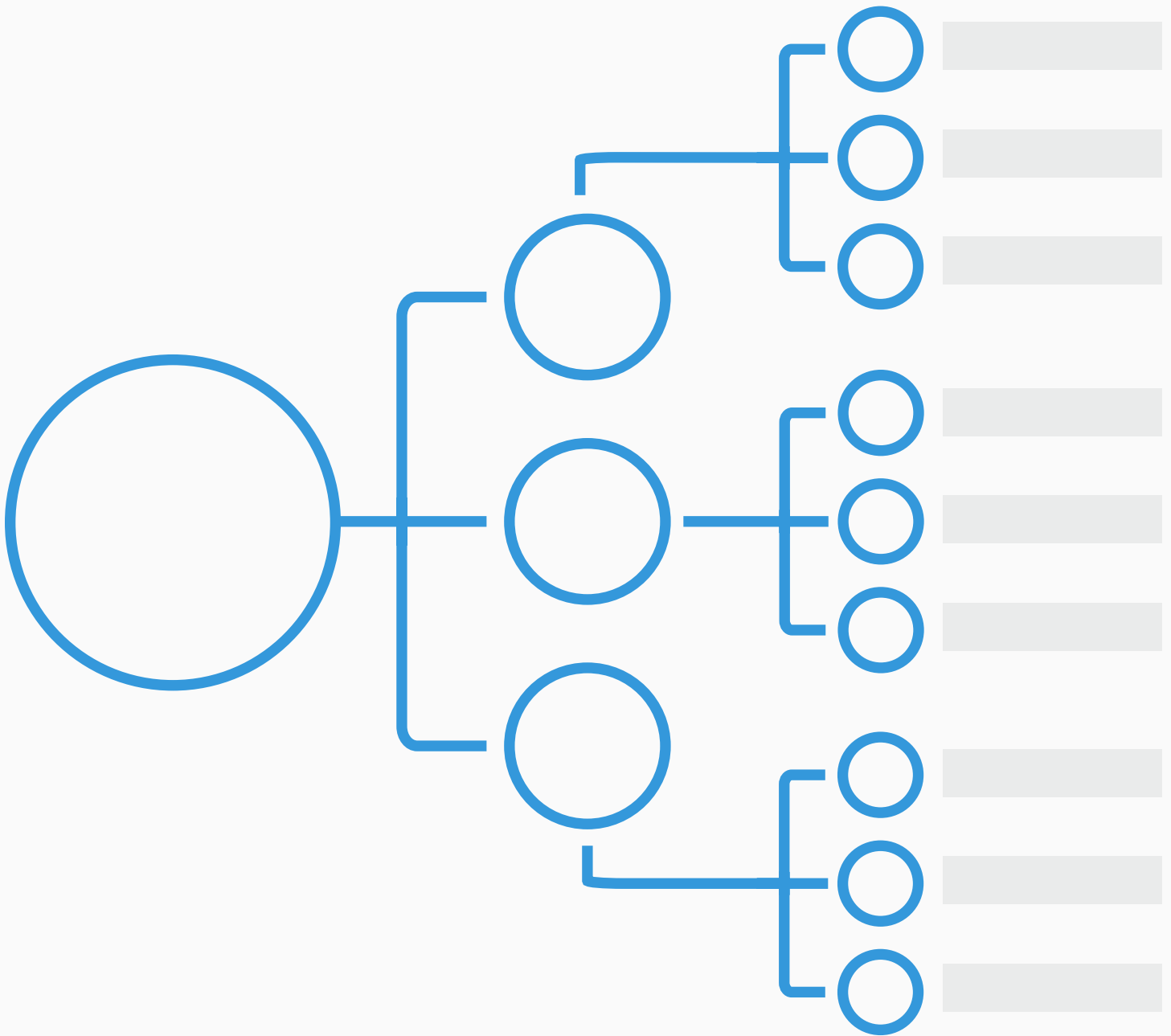
How much time would be required to build and implement each prototype?

How much money would be required to build and implement each prototype?

Now, use these criteria to choose three potential prototypes from within each of your variations. Then, use the prototypes to fill in the outer circles of the diagram on the next page.

ACTIVITY

GENERATING EVIDENCE

What you need: Completed diagram.

What you'll do: Assess appropriate experimental designs based on your potential intervention prototypes.

What you'll get: An empirical study design for your intervention idea.

Congratulations! You have refined your intervention idea, mapped its causal pathway, identified a key proximal outcome(s) of interest, and generated a variety of ways to prototype your intervention idea.

Now you are ready to design an experiment that can attempt to answer the question, "are any observed changes in behavior actually due to this intervention, rather than some other factor?"

By choosing an appropriate study design to evaluate your hunch statement, you can generate rigorous evidence, even in early stage evaluations.

The next page briefly covers when you might choose factorial designs, micro-randomization trials, or single-case experimental designs, which we recommend for evaluating the products of this Agile Science Create process. If you are unfamiliar with these experimental designs, we link out to resources that explain them in depth.

Factorial Designs

Use when:

- You have access to a lot of participants and want to optimize an intervention
- You want to evaluate multiple research questions in one design
- You are interested in the average impact of each component of an intervention
- You are targeting a behavior that only hapens once (e.g. vaccine) or relatively infrequently (yearly physical)

Resources

For more resources, please consult:

- [The Methodology Center](#) at Penn State, and keep an eye out for forthcoming books on the Multiphase Optimization Strategy (MOST)

Single-Case Designs

Use when:

- You want to test a complex intervention, but only have a handful of participants
- You want to quickly evaluate one component of an intervention

Resources

For more resources, please consult:

- [Single-Case Experimental Designs to Evaluate Novel Technology-Based Health Interventions](#)

Micro-Randomized Trials

Use micro-randomized trials ONLY when you can activate and deactivate components of an intervention, and effects can be observed within a day. Use when:

- An intervention can be used repeatedly
- You can measure a proximal outcome daily or multiple times per day
- You want to test multiple components simultaneously
- You are interested in how the effects of micro-randomized components change over time, and how they are moderated/affected by other time-varying factors, such as weather or location.

Resources

For more resources, please consult:

- [Microrandomized Trials: An Experimental Design for Developing Just-in-Time Adaptive Interventions](#)

- [Sample Size Calculations for Micro-randomized Trials in mHealth](#)

- [Sample Size Calculator for Micro-Randomized Trials](#)

Summary

Here are a few questions to consider as you choose experimental designs:

- Is the component having an effect at all?
- Does the effect of the component change over time?
- For whom is the intervention working?
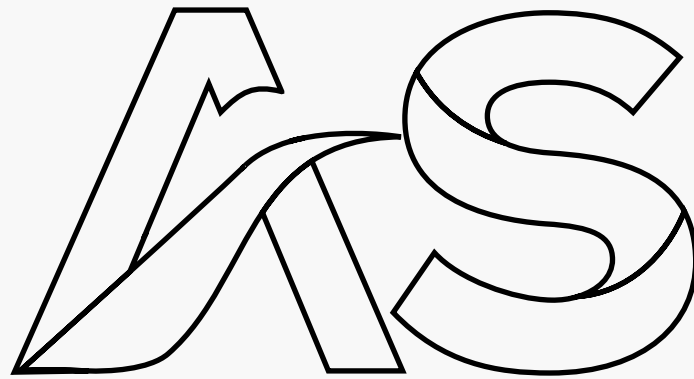- In what contexts does the intervention work?

Resources

For more help with experimental designs, please consult:

- Mobile User Research: A Practical Guide

- Design and Implementation of N-of-1 Trials: A User's Guide

- Methodologies for optimizing behavioral interventions: introduction to special section

We have found that this last section can be difficult for those with limited experience in experimental designs. If you would like our help, please contact us at http://www.agilescience.org. We offer the following services:

- Digital consulting by the hour to answer quick questions, offered to add depth to a part of the process
- One-day workshops to walk (usually a team) through this whole process, offered to facilitate repetitive use
- Multi-day workshops to apply this process in depth to a specific hunch, offered to produce a variety of potential prototypes to test in a selected experimental design

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