

# PlanSourcing: Generating Behavior Change Plans with Friends and Crowds

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## ABSTRACT

Specific, achievable plans can increase people's commitment to behavior change and increase their likelihood of success. However, many people struggle to create such plans, and available plans often do not fit their individual constraints. We conducted a study with 22 participants exploring the creation of personalized plans by strangers and friends to support three kinds of behavior change: diet, physical activity, and financial. In semi-structured interviews and analyses of the generated plans, we found that friends and strangers can help create behavior change plans that are actionable and help improve behavior. Participants perceived plans more positively when they were personalized to their goals, routines and preferences, or when they could foresee executing the plans with friends – often the friend who created the plan. Participants felt more comfortable sharing information with strangers and they received more diverse recommendations from strangers than friends.

## Author Keywords

Behavior change plans; crowdsourcing; friend sourcing.

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

Many people aspire and seek to change their behaviors to better themselves, such as eating healthier or exercising. However, doing so successfully is difficult. According to Norcross et al, six months after making a New Year's resolution, only 46% of people were still on track [32].

A critical barrier to changing one's behavior is not knowing where to start [1,9]: what can one do now? How can one

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adjust his or her routines? Various websites and mobile applications offer information on how to improve behavior. People turn to pre-existing plans that they can follow to change their behavior. Many online websites offer such plans, especially for common behavior change goals, including exercising more, eating healthier, or saving money. People seeking behavior change can find a number of plans to follow each day for weeks or months, e.g., plans to prepare daily to run a 5K [44], reach 100 push ups per day [45] or a 30-day plan to achieve a better financial footing [46]. These plans often include daily or regular activities that the participant should perform. The activities generally start off easy, e.g. : “5 min walk, 2 min jogging, 5 min walk”, and gradually become more difficult until the goal has been reached. Unfortunately, while many such plans have proven popular, these plans often feature little customization or limited ways in which they take into account individual constraints, values, and preferences.

Advances in technology reduce the barriers to soliciting help from friends, strangers, or peers. This can include seeking help from friends on social network sites, from strangers in online task markets like Amazon Mechanical Turk (AMT). Crowdsourcing and friendsourcing are increasingly applied to accomplish basic tasks and to answer questions [29,34,16]. Crowds and friends have also been used in some planning tasks, such as trip planning, or to do item planning [19,41]. We believe it is also possible to leverage crowdsourcing and friendsourcing in this more complex setting of generating personalized behavior change plans.

Thus, in this work, we aim to understand whether and how friends and strangers can help generate behavior change plans. We conducted a study (Figure 1) with 22 participants seeking to change their behavior and 66 planners (friends of participants and crowdworkers) who created behavior change plans. Each participant logged and shared their current physical activity, eating, or spending behavior for one week. The planners – friends recruited by participants and crowdworkers from oDesk (what has since been renamed to upwork) and Amazon Mechanical Turk – then used this information to provide one-week plans intended to help participants improve their behavior. We shared the plans created with our participants and interviewed them

about the content of the plans. We surveyed the planners, interviewed participants, and analyzed the plans generated.

We find that friend- and crowd- sourced planning can provide benefits for the behavior change process, in the domains of exercise, eating, and budgeting. Friends and crowd workers offer different benefits and different tradeoffs to the planning process, however. Specifically,

1. Participants reported the plans created for them were improvements over their current behavior, as did the expert who evaluated the plans. Further, asking for help from strangers results in diverse recommendations that people did not consider before.
2. Participants felt it was important that their plans incorporate information about their preferences, constraints, routines, and goals. Personal knowledge about the participant was relevant for creating plans that fit participant preferences. Friends already had this type of knowledge and used it when creating plans.
3. Involving others in planning behavior change comes with social costs in asking for help, worrying about being judged, and disclosing information to others. Participants primarily expressed these concerns with regard to friends but not strangers. The costs of sharing information with friends are balanced by benefits, such as anticipating receiving social support from and being held accountable to friends.

In the next sections, we describe the related work motivating creating behavior plans and getting information from crowds and friends. We then describe our study design, present results, and discuss the implications for design.

## RELATED WORK

Many people desire to change one or more aspects of their behavior but often fail to achieve their goals or to even start [43]. Common barriers include a lack of knowledge about how start, lack of time, competing responsibilities, lack of motivation, lack of access to necessary resources (e.g., healthier food or a gym) [43,47]. Other barriers include the belief that a different behavior would be inconsistent with their identity, innate ability, or social norms, and having uncertainty or skepticism about benefits of the change [6,21].

One of the most effective tools for overcoming these barriers is setting and committing to specific, achievable goals [23], often small [14]. This works particularly well when people develop these goals as implementation intentions: small steps with set times or triggers for each and ways in which they will act on them [15], which we will refer to as actionable plans. For example, someone might specify “I will run after work on Thursday, but if it rains, I will go to the gym instead.” People can increase commitment to and recall of the planned action by describing clear conditions under which it will happen. Developing actionable plans can also force people to consider whether and how the steps toward a goal will fit with their routines or other plans. In a study evaluating implementation intentions for diet and physical activity, Vet et al. find that, “to overcome or prevent self-regulatory problems, individuals need to get acquainted with

how to make plans and how to adapt plans to regulate their daily behaviors” [41].

Crafting an actionable plan from scratch is difficult, so many people turn to the Internet to search for plans [24,10]. While plans for common behavior change goals are bountiful online, many are of poor quality [38]. Even when the plan is of good quality, it may fail to account for diverse individualized barriers, needs, or opportunities [33], and end up being less effective [40] – or less likely to be tried – than a personalized plan [35,36].

In order to seek tailored plans, people seek advice from experts. Coaching, either face-to-face or online, has proved useful in reducing barriers to behavior change and increase individual likelihood of following through [25,36]. While plans are effective, people have difficulty creating them on their own without training. Many people do not have the resources to pay experts; the typical hourly wage for financial planners, dieticians, and personal trainers ranges from \$18-\$35 per hour [48]. People are unfortunately often unable to get coaching in the planning process.

Therefore, we sought to evaluate the potential use of friends or strangers to help develop behavior change plans. We pose the first research question:

### **RQ1. Can friends and crowd members generate plans that support behavior change?**

#### **Friendsourced and Crowdsourced Information Seeking**

Information technologies have greatly reduced the barriers to seeking help from other people. This includes seeking answers from others via social network sites (e.g., Facebook and Twitter) [29,12], getting answers in online communities (e.g., Social Q&A sites) [16], or even paying for help in online marketplaces for work (e.g., oDesk). Half of respondents in one survey say they engage in information seeking on Facebook or Twitter [29]. Multiple Q&A sites also boast millions of questions and answers (e.g., StackExchange, Quora).

#### *Asking for information from friends*

People commonly ask friends for pointers to resources answers to questions: “friendsourcing” [4]. Because friends are aware of or even share the same preferences as the person requesting help [39], friendsourcing may provide a viable and potentially valuable avenue for generating plans for behavior change. Advice and information from friends or family can also be accompanied by emotional support and a feeling of accountability to people who matter [31].

There are, however, potential challenges and drawbacks in seeking help from friends. First, people may be reluctant to ask friends about personal topics like health, dating, religion, or finance [29]. People feel uncomfortable sharing content that they consider sensitive, such as photos of themselves trying out clothing [28]. Second, while asking friends for help is usually free financially, it does incur social capital costs [37]. People might prefer not to make repeated requests

to friends [39,28], and sometimes choose to pay for receiving an answer rather than use social capital [37]. Responses provided by friends tend to focus on positive feedback and less on critique [28]. Finally, while similarity among friends help one be understood, it may also reduce the diversity of suggestions [27]. Friends' replies tend to be consistent with each other and to agree with previous responses, especially on platforms like Facebook, where replies are available for everyone to see. Together, these challenges limit both the number of requests people make of their friends and the diversity and types of responses received.

Despite these challenges, friends are able to provide help with small tasks such as information requests, opinions, or social coordination [13]. In the current research, we assess whether and how friends can help with creating behavior plans. Thus we pose this second research question:

**RQ2. What benefits and costs do friends offer for the creation of behavior change plans for individuals?**

*Asking for information from crowds*

Crowds have been used to help people tackle problems in various domains, including recognizing labels for people who are blind [5,8], offering fashion advice [28], helping plan a trip [42], managing email [20], and providing support for mental health [30,26], or for autism support [7,17].

Crowds have previously helped create step-by-step plans, including collaboratively generated travel itineraries and creating instructions for completing a to-do task (e.g., doing laundry) [42,19]. An evaluation of such a system, TaskGenies, found that people who receive actionable plans from the crowd were more likely to achieve their plans than people who were asked to create their own plans or who did not create plans at all [19]. The plans generated by crowdworkers offered steps to help people remember the actions they need to take, practice viewing and not ignoring tasks, and break the cycle of habituated inaction.

Crowds offer several benefits. First, crowds provide fast responses, being available even in real time on platforms like Mechanical Turk [2,5]. Second, crowdworkers may offer a diversity of backgrounds to which the requester might not otherwise have access. Crowds may also contain peers – others who have first-hand experience with similar goals and experiences and who can provide experience-based advice [39,17] – even when one's social network does not. Third, crowdsourcing need not be costly. People answer millions of questions on social Q&A at no cost. Many of these sites provide valuable answers and insights to behavior change (e.g. the subreddits r/Fitness, r/LoseIt, or the Physical Fitness Stack Exchange).

However, crowd workers could also have drawbacks: they may not know requester tastes and preferences [28], they can make negative comments that can be uncomfortable [28], and they might not have the expertise to answer questions for specialized topics [39]. Given these potential tradeoffs in

asking strangers for help, we pose our third research question:

**RQ3. What benefits and costs do crowdworkers offer for creating behavior change plans for individuals?**

**METHODS**

We designed a study to assess the benefits and costs of creating behavior change plans with the help of friends or crowdworkers (Figure 1). Friends selected by participants and crowdworkers from oDesk and Mechanical Turk created one-week long behavior change plans.

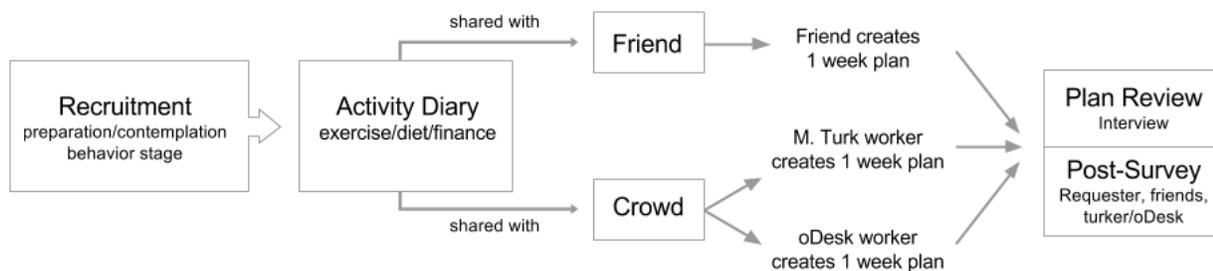
**Study design**

To compare friendsourcing and crowdsourcing across different behavior change domains, our study focused on three different everyday behaviors: increasing exercise, eating healthy, and saving money. These are common behaviors that people seek to improve and people commonly set them as New Year's resolutions [49].

To provide planners with baseline data about participant behaviors, we asked participants to first track their chosen behavior for a week in as much detail as possible using an online document, the activity log. Depending on which activity they were tracking, people logged the following information for: exercise – time of any physical activity and length in time, diet – time of any food consumed and what was consumed, finance – the amount of money spent and what was bought (Figure 3). We also suggested writing any relevant notes about their behavior that would help others create a plan for them. Before their activity log was shared with other people, participants had the opportunity to revise what they chose to share with their friend and with a stranger.

As part of the information shared with the planners, people included their age and gender. They also describe their goal, for example: “*My goal is to eat healthier. In particular I would like to increase my fruit and vegetable intake and try to consume fewer processed foods*” (P1) or “*I want to spend less than 150 a week!*” (P3). We also asked them to describe any constraints and preferences they had related to the activity, e.g., “*to avoid take out food and pack a lunch if I am away from home all day*” (P6) or “*I prefer running and live by a trail. I get bored doing the same thing two days in a row. I prefer going to the gym with a partner for motivation*” (P12). A complete list of goals and preferences can be found in Appendix 1.

We asked participants to recruit a friend to create a plan for them after they completed logging their activity (Figure 1). We recruited crowdworkers by posting job announcements on oDesk and tasks on Mechanical Turk. In the rest of this paper, we refer to these friends and crowdworkers as *planners*.



**Figure 1. Study Structure**

Each worker created one plan for one participant. Planners were given the participant’s description, goal, and activity log and asked to create a one week plan to help the person exercise more, eat healthier, or save more money. The planners had three days to create the plan. Workers on Mechanical Turk and oDesk were limited to working at most two hours on the plan. The planners were provided with a similar structure as the activity logs (Figure 2) in which they could create their plan. Other than that, we provided no other constraints so planners may flexibility structure and present their plans.

A sample of an activity log and instructions provided to the planner are available at the following github link: <https://github.com/eagapie/PlanSourcing-Generating-Behavior-Change-Plans-with-Friends-and-Crowds>.

**Recruitment and Participants**

Through Craigslist and a university mailing list, we recruited participants interested in increasing their physical activity, eating healthier, or saving money. Participants were screened using a survey to include only participants who were (1) not actively working towards their chosen behavior and (2) were considering or planning to change their behaviors (in the contemplative or planning stage of the transtheoretical model for behavior change [20]). Further, participants had to be willing to contact up to three friends to help them create a one-week long behavior change plan.

79 people completed the screener survey. Of these, we enrolled 63 participants in the study. 41 participants did not complete the study, either by not filling in their activity logs or not contacting a friend. 22 participants completed all the steps of the study. Out of the 22 participants, 8 had exercise goals, 8 had diet goals, and 6 had financial goals. Their ages ranged from 19 to 45 (mean=28 years), 17 were female and 5 male (Appendix 1).

Participants prepared a week-long activity log, recruited a friend, received plans prepared by three people (the recruited friend and two crowdworkers, discussed below), and completed a post-study survey and interview. They were compensated with Amazon gift cards: \$20 for logging activity for a week and contacting a friend and \$40 for the final interview.

**Planners**

For these 22 participants, we recruited 66 planners, including friends and workers on Mechanical Turk and oDesk. 60 of these planners completed a follow up survey (discussed in the next sections). Out of those, 19 were male, 40 female, and one identified as other. There were more females than males among oDesk planners: two male and 19 females. ODesk planners were recruited from the Personal Assistants role on oDesk. We chose this category because it included some oDesk workers with expertise in exercise, finance, or nutrition. However, these categories were not clearly delimited, so we recruited Personal Assistants more broadly.

The friend planners were recruited by the participants, and had known the participants for an average of 13 years, with a range of 1 to 35 years. Most friend planners were close to the participants: family members, spouses, siblings, other close friends. Only one friend planner was recruited from the broader network of Facebook friends of the participant. Each planner reported talking with the participants at least a couple of times per week. Friends were compensated by entering a lottery for one \$25 Amazon gift card per every 10 participants. Planners on Mechanical Turk were compensated with \$5 per task. Workers from oDesk bid for the task, varying between \$3 and \$33. The workers who received the lowest hourly wages had no reputation and said they wanted to perform work at low-cost while building their reputation. All crowdworkers were selected from the US.

**Planner and participant surveys and interviews**

We explored the participants’ assessment of the plans quality through a survey, which included quantitative measure of

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time of day | meal name | meal content | notes
8 AM | breakfast | sandwich with whole wheat bread, ham and
veggies | some explanation why this item is a healthy decision

Monday
___ | breakfast |
___ | lunch |
___ | dinner |
___ | snack |

```

**Figure 2. Example Template that participants used for creating a food plan**

Participant	Activity Log	Plan (partitioned from full plan)
<b>P10 Diet</b>	<b>Sunday</b> __8AM__   breakfast   nothing __12PM__   lunch   nothing __6PM__   dinner   steak and salmon with rice __1AM__   snack   creamcheese fruit tart	<b>Sunday</b> _7_ _30_   breakfast   Special K Cereal with Low fat Milk _12_ _00_   lunch   Salad with Mixed Greens and either Chicken or Lean beef for protein. Add in Olives, Avocado and Nuts for additional Healthy Fats. Balsamic and EVOO for dressing.
<b>P2 Exercise</b>	<b>Tuesday</b> 6PM   1 hr   Life   Moving from old apartment to new, heavy lifting, stairs	<b>Tuesday</b> 8:00 AM   HIIT   30 second walk (brisk), 30 second sprint. 8 minutes total workout
<b>P7 Finances</b>	<b>Thursday</b> __   3.32   fast food __   8.51   Netflix __   6.34   Drink and pretzels for snacks for class	<b>Thursday</b> \$0   You've already spent money on groceries, bring a lunch you made at home to work and eat dinner at home. \$0   Evening Entertainment: Read a book, watch TV, or play a video game. Maybe have a friend come over.

**Figure 3. Example activity logs and plans for three participants.**

Plans illustrate justifications for the recommendations along with explanations on how to execute steps (e.g. food recipe)

likelihood to follow plan, perceived improvement in behavior and perceived fit with the person.

We also interviewed them about the quality of the plans and their current and previous behavior in relation to the activity they wanted to improve, and how friends and strangers contributed to the plan. The plans were presented to the participants in a random order and without revealing which plans were created by the friends or by strangers, until after the plans were evaluated.

Planners completed a survey at the end of their task. The survey included questions about demographics and their experience creating the plan. For example, what information did they use to create the plan? What other information would have helped them create the plan? We interviewed some planners to understand more about their process of creating the plans.

#### Expert Evaluation of Plans

Further, to objectively evaluate the quality of the plans, we hired experts to qualitatively rate each plan: a registered dietitian, a high school teacher who taught personal finance classes for several years, and an accredited Aerobics and Fitness Association of America instructor. We chose these people because they were accredited to have expertise in the same domains as the plans, and were teaching or counseling people in behavior improvement. The experts analyzed the information in the plans and rated how much of an improvement the plan would be for the person, if followed. They noted which items and strategies supported or did not support the participant's goal in each plan.

#### Descriptive Analysis of Plans

We conducted an exploratory analyses of the plans received to see if there are any major differences across type and source of the plan. This included: the presence of justifications for the steps, links to external resources, or recipes. We also measured the word counts for each plan and compared them based on the type (exercise, diet, or finances)

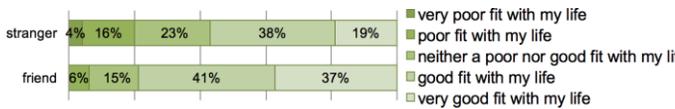
and source of the plan (friends, crowdworkers). Special characters were removed during the text processing, but no other words were omitted from the text.

#### RESULTS

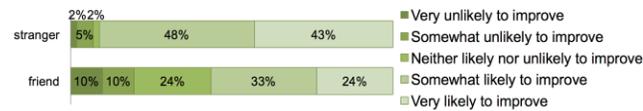
We describe the plans and activity logs produced by the participants and the planners, and how the plans were evaluated by the participants and the domain experts. We will discuss what we found as the most important aspects of the behavior plans and how the friends and crowd members contributed to this.

#### Overview of Plans

Planners generated plans that ranged in levels of detail (Figure 3). Some were very basic plans with minimal modification from the original activity logs: two to three meals and one or two snacks a day for diet plans, and a few or no entries a day for exercise and financial plans. Some plans were more elaborate and included additional information that was not requested in our instructions. For example, diet plans included links to, or details of recipes, portion sizes and calories per meal; exercise plans included full descriptions of how to perform physical activity exercises; finance plans included links to money-saving applications or budget websites. Some planners also included information about why a recommendation would be beneficial: *“spending a little more at the grocery store will save you money later by not going out to eat”* (P16). Some plans included introductory paragraphs that explained what the goal of the plan is: *“Before starting any work-out it is very important to warm up first. The effectiveness of your warm up will prevent the likelihood of injury”* (P9). 46 of the 66 plans included specific details on how to execute a routine, prepare a food or general strategies that went beyond the exact step that was prescribed. 27 of the plans included justifications for why to follow a particular recommendation. Justifications were more common in stranger plans (4 were in friend plans, and 23 in stranger plans).



**Figure 4. Fit with participant lifestyle of stranger and friend plans**



**Figure 5. Expert Improvement Assessment of stranger and friend plans**

To examine how plan length varied between plan sources and across topics, a mixed effects regression model was used, where participants who received multiple plans was treated as a random effects variable. We found that stranger plans (M=544 words) were in general longer than friend plans (M=313 words;  $t(43)=1.98, p=0.05$ ). We attribute the longer length of crowd member plans to them adding more justifications and explanations on why to follow a particular recommendation. This was uncommon in the friend plans.

In addition, we also found that plan length varied by domain. Food plans were almost twice as long as exercise or finance plans (Table 1). Compared to exercise as the baseline, food plans were significantly longer ( $t(19)=2.40, p=0.03$ ), while finance plans were not significantly different from the exercise plans. Additional analyses show that activity logs which seeded the plans had the same property, which can explain the difference in plan length across domains. Food plans included several items for each meal of the day, along with occasional notes for each item. In contrast, the other domains had at most one or two recommendations for day, and did not require the same level of granularity needed to describe each meal.

### Evaluation of Plans

To examine the potential of these friend and stranger generated plans to support behavior change, we evaluated the plans based on participant assessment and expert evaluation.

#### Participant evaluation of plans

Overall, participants believed plans would help and felt they would follow them. Participants rated 74% of the plans as likely or very likely to make an improvement to their current behavior. 50% of the plans were rated as either good or very good fit with participants' life, and participants said they are likely or very likely to follow 56% of the plans. In comparison, only 13% of the plans were perceived as not offering an improvement, 24% as not being a fit, and 30% as not likely to follow the plans.

To explore how these perceptions differed across plan source we conducted multiple ordinal mixed effects regression analysis modeling the plan source (friend or crowdworker) and topic as primary independent variables. We found that friend plans were rated higher than stranger plans in terms of fit with lifestyle (1.95 times more likely to be rated at a higher level,  $p=0.03$ , Figure 4). As we will discuss later, this is most likely due to the additional information that friends

Domain	Plan Length Activity Log Length	
	mean (std dev)	mean (std dev)
Exercise	293.1(493.0)	122.1 (46.2)
Diet	622.1 (464.4)	432.3 (291.8)
Finances	300.1 (212.1)	206.1 (130.2)

**Table 1. Plan length in words varies across domains, food plans being longest and financial ones shortest**

had about the participants that strangers did not. There were no significant differences across source in terms of perceived improvement and likelihood to follow. Topics was also not a significant factor in these models.

It is important to note that participants were asked to make their assessments without knowing the identity of the source. This was to minimize potential biases in assessing these plans (e.g., more positive towards friends' plans because participants chose them). While participants may try to guess which plan was generated by whom, they were never certain. In the pre-interview survey, when asked to identify the source of each plan, only 11 of 22 participants correctly guessed which one was from the friend.

#### Expert assessment of plans

The expert evaluators ranked the plans based on how much of an improvement the plans were to participants' current behavior. Like participants' assessments, the experts also thought these plans can help. They rated 79% of plans as likely or very likely to improve the participant's behavior.

To explore if the quality of plans is influenced by the source or domain of the plans, we conducted an ordinal mixed effects regression analysis on the ratings by the experts. Experts rated stranger plans as providing greater improvement than friend plans (2.04 times more likely to be rated at a higher level,  $p=0.01$ , Figure 5).

### PLANSOURCING WITH FRIENDS AND STRANGERS

Through our analyses of survey and interview data, we gained a number of key insights about behavior change plansourcing, and the benefits and costs associated with having friends and strangers create these plans.

#### Personal Knowledge Relevant to Plans: Preferences, Routines, Goals, Constraints

Participants reported they were more likely to follow plans that fit with their lives, and that these plans reflected specific knowledge about their lifestyle. From surveys and interviews, we identified four types of knowledge that plan recipients valued, and that can help planners to make better recommendations: preferences, routines, goals and constraints.

**Preferences.** Participants appreciated when plans were tailored to their preferences: what food and exercises they enjoy, things they like to buy for themselves, at which stores

and what they usually shop, and things that were important for the participant and they were reluctant to give up.

Several participants (P8, P9, P11, P13, P14, P20) noted that friends had this information but the other planners did not; they recognized the value of the friend knowing them well.

*"I do like the treadmill elliptical [...] that's something my friend knows about me"* (P13)

*"I know that [my friend] did Plan C because he knows my attention span. [...] Because exercising is really boring for me."* (P8)

The fitness expert also emphasized the importance of responding to participant's preferences. She was critical when the suggestions did not appear to be responsive to participant preferences: *"If followed the plan would increase physical activity, but it may be difficult to follow since it doesn't take into account the user's preferences."* The finance expert was encouraging of plans that offered strategies that were responsive to a person's needs and resources, rather than substitute activities or generic advice: *"I like the idea of shopping ahead of time and making meals for the week. However, this felt like a cut and paste plan instead of an honest approach to the person's particular spending needs"*. He also was critical of plans that suggested substitute activities that did not meet a participant's reason for spending, e.g., *"The suggestion to stay at home and read books doesn't address this person's needs."*

In other instances, planners suggested cutting items or activities that participants felt were important to them:

*"this does not seem very foodie. I like my food yummy"* (P10 about stranger plan)

*"The Birch Box [a monthly subscription to grooming supplies] [...] I don't know if I want to cancel it [...] I know that it does add up, but I really like it. It's given me a lot of happiness. It's one of my vices"* (P16 about stranger plan)

**Accommodation of Routine.** Participants also felt that it was important that plans accommodate their routines. Participants appreciated when plans fit with their schedules: when they exercised, ate or shopped, what they like:

*"knowing my schedule, knowing how I work ... knowing how unproductive I get ... I think it just comes from knowing somebody for so long so well"* (P8 about friend plan)

Plans sometimes did not fit with routines, such as whether participants cooked (P11), schedules for eating and exercising (P2, P13, P15), or how often they visit the stores where they spend money (P3). Sometimes planners made suggestions that did not apply to the participants, such as a breakfast menu (P6, P10, P15) for participants who do not eat, or want to eat, breakfast. Each such conflict elicited negative reactions from the participants.

**Constraints.** Participants had various constraints, such as dietary or physical activity limitations. Three participants had medical conditions they did not include in their activity log but that were relevant to creating a diet or exercise plan (P1, P5, P15):

*"She knows that I love to play basketball but that I had surgery on my ankle and I have a steel plate in there. That definitely limits me"* (P5 about friend)

Similarly, plans including suggestions that required resources or opportunities to which participants do not have access, were frustrating, as participants could not follow them:

*"I don't have access to a bicycle or a swimming pool right now and I don't have a yard or a mom [to visit], there's just not enough here that applies to my life"* (P5 about stranger plan)

**Goals.** Participants complained that many plans were not a good fit for their goals, e.g., the plan did not include enough food (P11, P14), or too little exercise (P5, P8, P9, P13).

*"I somewhat expected to be given more than I actually do. I expected more, but this is not as much as I expected."* (P13 about friend and stranger plans)

Some participants thought that a friend knew their goals better than strangers did, creating more tailored plans, e.g., P2 found the friend plan, tailored to muscle building more of a fit with their goal:

*"So I'd see a lot of walking, gym, elliptical, stuff like that whereas ... my friend knows me a little better. He knew that that wasn't probably what I really wanted to do and he made something completely different"* (P2 about friend plan)

The fitness expert pointed out that some plans suggested potentially risky increases in physical activity, or increases that were too insignificant to the participant's goal and current activity level.

Planners appreciated clear descriptions of participant goals, and mentioned it as part of the most relevant information in creating the plans for 12 of the participants.

**Role of Planner Knowledge About Participants.** Unsurprisingly, friends knew more about participants than strangers did. Many participants specifically chose friends who knew them very well (P7, P8, P9, P11, P14, P15, P20):

*"we know each other pretty well and we grew up together so we know how easy it is to gain weight, or if it's harder to lose weight, so we can relate to each other. It's kind of more personal information, where she already has all the background. So I don't have to explain"* (P14 about friend plan)

Of the 17 friend-planners who responded to the survey, 11 had known the participant for more than five years and were very close to the participant (closer friends, family members, significant others). In contrast, crowd members had to rely

on only the information from the activity logs to infer people's preferences and constraints. When plans included information that was tailored to them, participants noticed it quickly and would often realize the plan came from their friends - "[doing] something crazy [like a group activity of capture the flag] sounded like something my friend would say" (P12). Friend advice did not always match the routine of participant, but only rarely were the recommendations a poor fit with their routines.

Although friends knew more about participants, they did not always know detailed information about their friends' activities. Consequently, they still benefitted from having the activity log while generating plans:

*"I noticed there was a powerless feeling ... so she'd have some herbal tea ... some kind of pick-me-up in the afternoon ... so that was something that stood out to me ... So when I made my plan, I tried to maintain that for her so that she could still have a cup of tea or something later in the day"* (friend planner about P1)

In contrast to friends, crowdworkers do not have insights about the participants beyond the activity logs. Crowdworkers mentioned they tried to tailor plans to participant needs based on what they inferred participants liked from the log:

*"Looking at his taste in food ... I know he likes breakfast ... He seems to have a lot of time in the morning so I went off that and gave him a healthy breakfast ... I can tell he likes meat from his diet"* (stranger planner about P22)

The participants also recognized this, and on some occasions crowdworkers were perceived as having in depth knowledge of the participant (P3, P10, P15):

*"even the people who weren't my friends [...] would fill out the plan more tailored to what I had put [in the activity log]"* (P2 about stranger planners)

*"I feel like this person knew me. They knew I liked to shop they knew I like to go buy Scratch tickets. I feel like they knew everything that was important"* (P3 about stranger planner)

Participants also used knowledge about their friends' habits, routines, and expertise for the target behavior, in their selection which friend they would ask to generate the plan (P1, P4, P13, P15, P16, P17). Some participants selected the particular friend they asked because the friend was good at the behavior the participant wanted to change (P2, P5, P9, P13, P16):

*"she's on a health kick and exercising and eating right"* (P9 about friend).

### **Costs and Benefits of Diversity of Recommendations**

Participants had mixed reactions to diversity of ideas in plans. They wanted plans that contained novel suggestions, but, as discussed above, they also wanted plans that fit with their existing routines, goals, constraints, and preferences. These two desires were often at odds. Participants liked the

simplicity of plans, but that came in tension with plans becoming boring or insufficient.

Participants noted that crowd-generated plans were more likely to contain novel ideas. Almost every crowd-generated plan contained one or more suggestions the participant had not previously considered in introducing in their behavior. Participants perceived this both negatively and positively. When their ideas resonated with them, they were enthusiastic to try new ways of changing behavior. This included trying new foods (P15), new exercises (P2, P5), and new strategies for improving behavior, such ideas for how to eat less of something unhealthy (P11), how to balance foods better (P1), and how to budget better (P16):

*"I would usually put [use] those things if I had them, but I probably wouldn't think to get them at the grocery store"* (P14 about stranger plan)

*"They mentioned sprouted grain bread, which I didn't really know about. ... I had never heard of it before so I looked it up and it seems good. That was a food that I learned about"* (P15 about stranger plan)

For these new ideas, participants appreciated references to more details: links to how to cook a recipe or apps for budgeting (P3, P4, P16). On the other hand, many of the novel ideas were not well received because they were inconsistent with participant preferences, constraints, and routines. In these instances, participants were not enthusiastic to try them.

Plans that were close to the current behavior of the participant were perceived as easier and less risky to follow. These small changes were seen as easy to implement. This was a characteristic of both friend plans (P11, P13, P20) and stranger plans (P1, P3, P4, P8, P9). Participants liked when plans were similar to what they were already doing (P1, P3, P4, P9, P11, P20). They also valued a level of repetition, such as cooking the same meal or shopping for groceries fewer times a week (P1, P11, P15), could easily fit into their schedule (P5, P9). P10 valued a plan that used resources she already had on hand, and P15 expresses the preference to be repetitive:

*"many of these things I already have in my cabinet and fridge so that was nice. I didn't have to go out and buy anything, and a lot of the stuff I like to eat."* (P10 about friend and stranger plans)

*"I like that it's really repetitive because I like the idea of eating different things but in reality I tend to be the kind of person where I'll just eat the same thing every day for weeks."* (P15)

On the other hand, plans similar to one's current activity were also seen as not being beneficial: participants noted they seemed boring (P10, P12), or insufficient in the amount of change recommended (P5, P8, P9, P13, P14). Some participants (P10, P12, P13, P14, P20) had hoped that the plans would contain more new ideas that deviated from their

routines. Participants were also skeptical that plans similar to their current behavior would offer them much improvement:

*"It just looks like something I would write because I think my plan was similar to this. [...] It's a little boring. There's no variety. You're doing the same exercise."* (P12 about friend plan)

*"it's very similar to what I was eating before ... I don't think it will change my eating habit ... it's going to be much harder to think that I'm changing my eating habits and so I will want to go back to what I'm used to eating"* (P20 about stranger plan)

Friends, overall, tended to produce plans that were more similar to what participants were already doing or had already tried. This is perhaps because they are similar – participants mentioned picking friends who are similar to themselves and who have similar habits (P1, P2, P14) – and because they used their knowledge about friends to tailor the plans:

*"she and I both want to be a little bit better and so because we have... we know each other, we have similar personalities, we have similar goals when it comes to diet, in terms of eating and exercise"* (P1 about friend)

Both friend and stranger planners recommended changes that they had tried or were trying themselves: food they liked, ways in which they saved money. Participants were better able to see this in plans produced by their friends – because they often knew about their friends' efforts and successes but had no way of knowing about similar efforts by stranger planners. Not knowing about the crowdworkers expertise or experiences made participants reluctant to trust the crowd members (P1, P17): *"the fact that they're not nutritionists I guess would make me trust them less"* (P17).

In some cases, planners and participants favored strategies of which experts disapproved. For example, some planners included and participants particularly appreciated "cheat days" – opportunities on which the participant could eat what they wanted – but the dietician did not agree with this practice. Sometimes, planners also tried to accommodate participant preferences that experts thought were not helpful. For example, food plans might include favorite desserts (P10) or allow a participant to skip breakfast, with which the dietician disagreed. The financial expert favored strategies that helped save money, like do it yourself projects, setting a cap on money to spend when shopping, or long term plans for saving money.

### **Effects of Social Relationships on Planning**

Participants showed interest in following different parts of the plans in the company of others who could keep them accountable and provide support. When discussing plans from their friends, participants looked forward to having the friend participate in the plan's activities. However, participants had limits in how much, and what, they wanted to share with others. Participants were more comfortable

sharing with strangers and more concerned about judgment from friends.

**Friends Are Available for Future Interactions.** Participants noted that plans generated by friends came with additional potential social benefits and costs. Participants selected friends to complete the plan in part based on the social support they anticipated they could offer. Some participants commented that the behavior they sought to improve was something they have done in the past with the selected friend, such as exercising (P2), eating or dieting together (P1, P10, P13, P15, P16). They also anticipated that asking friends to craft the plan might encourage them to further support each other, e.g., *"we could look for foods together and support each other"* (P15). Some saw potential for doing planned activities together: *"we could ride bicycles together and then walk together"* (P5), or *"we need to eat better together"* (P11).

Friends thought they could benefit from exchanging plans, because even the friends felt like they could learn from the plan requesters:

*"Another thing that was good for me was that it was mutually beneficial in the sense that I think I could get ideas from her."* (friend about P1)

Some participants noted that the planning process created a possible accountability mechanism with the selected friend (P4, P15): *"It would be nice for us to be accountable to each other"* (P4).

**Social Cost and Judgment in Asking for Help.** All participants contacted people they knew well. They did not want to impose on other people by making a request that seemed somewhat demanding. Some participants had a hard time contacting people to request their time for creating the plan (P1, P6, P15, P16):

*"I didn't want to place too much burden on my other close friend so I thought of my sisters first and then I thought of my husband"* (P1 about friend)

Consequently, participants chose planners primarily based on how close they were to them and how willing they would be to help, while concerns like expertise or experience with the target behavior were secondary.

Participants were also concerned about what the request would signal to their friends, or that it would violate norms of what they talk about. P6 was worried his friends would think something was wrong with him, P13 thought other people would think it was inappropriate to talk about healthy eating where she lived. P10 said that her friends do not discuss healthy eating because it is associated with weight loss.

One participant was concerned that asking a friend to create a plan could lead to potential conflicts, such as more accountability than they wanted or hurt feelings about not following her friend's advice:

*“my boyfriend can give me a plan, but he's with me when I'm doing all this stuff. [...] this person told me to do X, Y, Z, that doesn't mean that I can be like oh I'm not listening to your suggestions.”* (P3 about friend plan)

Participants had a difficulty receiving negative feedback from friends. When friends offered participants feedback perceived as offensive, participants felt it would affect their relationship (P7, P16):

*“I'm kind of wondering about how it's going to be to see her the next time I see her. If we're going to talk about it and I don't particularly want to and just kind of wishing that she was more practical and understood my needs a little bit more.”* (P7, about friend plan)

The financial expert also felt that the activity log format led many financial planners to critique past participant behavior rather than offer strategies and meeting participant needs, he pointed this in both stranger and friend plans *“It's an assessment of the spending from the previous week. These are judgments, not recommendations for better spending.”*

Friend-planners described not wanting to make strong statements about their friend's behavior, as this was not the sort of advice typically offer in the context of their friendship:

*“It would be kind of mean because maybe it's something that he knows he spends too much on. I don't know, I think it would be a little insulting if I just saw overall the things he spends too much on and told him about it”* (friend about P18)

Participants felt some suggestions that crowdworkers made, such as avoiding a hypothetical DUI [driving under the influence of alcohol] citation by drinking at home rather than the bar, were judgmental or inappropriate:

*“to get a DUI [driving under the influence of alcohol] on your travel home [...] that's kind of a little condescending.”* (P16)

Crowdworkers mentioned feeling comfortable providing criticism, as they did not have an ongoing social relationship to protect with the participant. This helped them suggest greater changes from participant behavior:

*“I didn't find that it was too difficult [to cut items from the plan]. That was easy just because I had seen some frivolous things that they were buying”* (stranger planner about P3).

**Disclosure Concerns.** Participants did not describe privacy concerns about sharing their activity logs with their selected friends and some participants said they would not mind sharing everything in their activity log with others (P1, P6, P16, P17). Participants noted that they chose a certain friend because they already knew about their behavior or because privacy would not be a concern with them, even if it would be with others. Others preferred to not share such information with others because they felt the topic was inappropriate to discuss or share information about (P1, P13,

P16, P17). For example, P17 had health constraints that she did not want to share with others, and so she was reluctant to contact people other than her partner and parents. P1 was concerned about how others would perceive her eating habits:

*“I would feel embarrassed for them to know how infrequently I actually am sitting down to a meal”* (P1).

All interviewed friends felt they were familiar with all the aspects of the participant's activity log, even if they were not familiar with all the details in it: *“I wouldn't have been able [...] to recreate all the details but it's, let's say, it wasn't surprising”* (P14).

Participants were not reluctant to share information with crowdworkers and several felt more comfortable sharing with crowdworkers than friends as they would not feel judged by these strangers:

*“They don't know me. They can't really judge me, and even if they do, it's not like I will really know about it. I don't know, it's just easier”* (P3).

Although participants were comfortable sharing their activity plans with strangers, some participants said they had limits, such as sharing their income or where they live (P4, P16).

## DISCUSSION

In the current work, we demonstrate a process by which people can ask strangers and friends to create personalized, actionable behavior change plans for them. We find benefits in using others' help, but also find tradeoffs in using different type of planners – friends and crowdworkers – and what they have to offer in this process. Our results can inform the design of systems that support behavior change, including exercise, dieting, and budgeting tools.

Several aspects of behavior change plans are important to participants. Friends and strangers recruited from crowds differ in which aspects they best support. Designers of systems that enlist the help of others to create behavior change plans should consider the following:

**(1) Sharing information on routines, preferences, constraints, and goals.** Perhaps not surprisingly, knowledge about the participant allowed planners to generate plans that seems more appealing and more possible to the participants, similar to findings in prior work in friendsourcing and social support [39,28]. Our work adds to prior findings but also concretely outline categories of these contextual information that are valuable to share. Specifically, we found that routines, preferences, constraints and goals are four useful categories of information that can enable the planners to generate more personalized and better perceived plans. Systems should collect information about user activity as behavior baseline, but also facilitate the collection of these relevant personal information. Once this data is collected, systems also need to focus on how to best represent personal, and behavioral data to crowd members, or friends.

These findings can also more broadly extend to the design of general online Q&A and peer support communities. Offering this set of contextual information may help answerers better understand the question askers and provide more personalized feedback. These communities may make these types of information required when submitting a question, or allow users to share these types of personal information through rich profiles.

**(2) Facilitating longitudinal interactions.** In our work, we found that participants felt supported by receiving plans from friends, and they felt their friends could continue to offer social support as they worked to follow the plans. They also saw the friends who generated the plan as potential accountability partners or sources of instrumental support by participating in activities together. There is value in having planners continuously engage with participants over time, aside from just the planning stage.

This is an important area of design and consideration and exploration for behavior change plan creation systems. How might we enable longitudinal interactions, especially for planners who are strangers, to build on these potential benefits? Crowdsourcing systems have previously attempted developing relationships between a user and several crowd workers posing as one conversational assistant [22], however for only a short period of time. Through such longitudinal interactions, crowd workers could learn about requester's context over time, making them more effective planners. Systems can also consider pairing up crowd members and requesters in similar geographic areas, which could lead to opportunities to do things together, similarly to how running groups of meetups leverage on location.

Again, these insights also extend to general crowdsourcing systems. Previous work in crowdsourcing for fashion advice for blind [11] people has shown that such sensitive tasks can be suited for strangers and discusses strategies to pair up with trusted others. But aside from just task-based needs, these systems may also enable interactions that can satisfy social support needs.

**(3) Combining friends and strangers.** Many of current crowdsourcing systems use workers who are complete strangers, or make no differentiation between strangers and friends in the system [5,3,42]. Our findings point out the potential and offer some specific guidelines for using a hybrid group of workers to serve different roles to generate behavior change plans.

In general, our findings support prior research that has found that asking other people for help incurs a variety of costs, such as inconvenience to others and concerned about being perceived as less competent [37], or social capital costs [37,28]. But our research further highlights some critical differences between friends and strangers and suggests specific ways in which the social costs with asking friends for help can be greater than asking strangers for help. For example, participants reported being concerned about

sharing personal information with friends, or worried about offending friends if they do not end up following their advice.

This, coupled with the finding that more novel ideas were offered by strangers, suggests that in an early ideation stage of the process, the larger quantity and more diverse group of crowds of strangers may be considered to generate ideas.

On the other hand, we found a clear benefit of having friend-planners who have contextual knowledge of participants. These friends may be best used to give critical insights of the participants and overlook the plans being generated by crowds. In the Find-Fix-Verify crowdsourcing process suggested by prior work [3], our suggestions could roughly translate to having the cheaper and higher quantity crowdworkers work on finding and fixing problems, and reserving the friends to verify the tasks and add the final personalized touch. This type of hybrid workflows can aim at minimizing the costs, such as reducing the costs involved with asking friends for help, while maximizing the benefits, such as receiving diverse yet tailored recommendations.

## LIMITATIONS

We designed our study to consider a range of topics. We also kept the planning interface simple to allow planners flexibility in generating and presenting their plans. While we think our findings led to valuable insights for plansourcing for behavior change in general, more research is needed to test and confirm our findings with additional participants (and different planners), across other topics.

In addition, we utilized a number of measures to evaluate the generated plans, from both the perspective of the participant and experts. A limitation of our approach is that we do not have any behavior measures on how these plans may affect the participants. It is possible that participants and experts may misjudge the efficacy of the plan without trying it out first. Nonetheless, we do believe that findings from the metrics used are valuable. If the users do not "perceive" benefits, they would not even start, regardless of how beneficial the plans may turn out to be. Our metrics offer a first step in exploring plans created by other, and is a common strategy in evaluate behavior change interventions [18]. Through our work we contribute with initial insights into how the help of others can be used for behavior change.

## CONCLUSION

Findings from this work suggests that our friends and strangers may be able to help us generate actionable, useful, and appealing behavior change plans.

Through a study in which we asked friends and strangers recruited from crowdwork sites to create behavior change plans for others, we identify specific types of information that makes plans to be perceived as good. These include having a plan tailored to the participant preferences and goals and receiving diverse alternatives to their current behavior. Planners benefit both from when participants feel comfortable sharing sensitive information and when they

have an existing relationship that can offer social support for behavior change. This creates a tension in sharing the most useful information for creating the plans.

We plan to design and evaluate designs that can best harness others for the generation of behavior change plans. This involves soliciting the relevant set of information from users, developing the interfaces to create and edit plans, the optimal use of friends and crowds, and assessing how the plans might need to change as the participant starts executing them.

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Appendix 1

ID	Domain	Gender	Age	Goals	Preferences/Constraints
p1	food	Female	35	My goal is to eat healthier. In particular I would like to increase my fruit and vegetable intake and try to consume fewer processed foods	Restricting (but not eliminating) dairy and wheat.
p2	exercise	Male	26	Go to the gym more, routine exercises. More walking, gradually turning into jogging.	Simple, common lifting exercises. Gym facility doesn't have a lot of equipment.
p3	money	Female	27	I want to spend less than 150 a week!	N/A
p4	money	Female	33	I'd like to reduce eating out costs to \$40 max, and grocery costs to \$75 max, both per week	N/A
p5	exercise	Male	N/A	N/A	Sports/No Constraints
p6	food	Male	45	I might be joining a weight loss group next week or so, if my schedule allows.	My preference is to avoid take out food and pack a lunch if I am away from home all day. I do not have any constraints
p7	money	Female	27	less spending on costumes, online shopping, and going out to eat	I want one night a week I can go out and have fun, but know my spending was out of control
p8	exercise	Female	23	My goal is to exercise at least one hour 5 days per week	I have a rotator cuff injury and prefer cardio.
p9	exercise	Female	23	I want to work out more.	N/A
p10	food	Female	19	N/A	N/A
p11	food	Female	25	My activity should increase my activity by walking. Also to have one serving instead of two or three.	I like to walk but I am always sitting at work
p12	exercise	Female	31	Be active/exercise every day of the week for at least 15 minutes.	I prefer running and live by a trail. I get bored doing the same thing two days in a row. I prefer going to the gym with a partner for motivation.
p13	exercise	Female	35	variety of exercises	none
p14	food	Female	27	Eat more fruits and vegetables; I am not sure how to get 5 fruits/vegetables a day (let alone the 7-9 my doctor recommended) without going way over my budget or having to shop again midweek.	I tend to go to the store once per week, and try to stick to Trader Joe's. Every other week I will go to another store with a wider selection of produce.
p15	food	Female	27	eat more regularly and eat healthier, hopefully lower carb, foods	nothing you don't know about... all the usual migraine triggers
p16	money	Female	26	i would like to spend less on eating out, and not purchase decorative items	i will be purchasing some things still for my wedding, but i hope that the bulk of the spending for this is done. I know i need to book another hotel soon though.
p17	food	Male	28	I want to eat better	I want to still be able to eat meat
p18	money	Male	26	Would like to spend less on online shopping & gas.	none
p19	exercise	Female	25	Yoga once a week, walking around Greenlake 3x a week	N/A
p20	food	Female	18	Usually I just wait until I feel hungry before I eat anything and I think that is one of the reasons my eating habits aren't very good. I am hoping I could incorporate more fruit into my everyday life. I usually don't crave fruits so I tend not to eat them that much.	No beans, nuts, pineapples, strawberries, an additional 20 dollars can be spent outside my normal weekly food budget
p21	exercise	Female	35	3 trips to the gym of at least 1 hour each	N/A
p22	money	Female	54	(1) Save money by managing my time better--ensuring I have food at home and eat before I go out so to avoid having to spend money on food and drinks. (2) Attempt to quit smoking again by resuming my e-cigarette. (3) Attempt to make Michael more responsible for his own debts.	Ref (1) above: Shop for groceries at Fred Meyers not farmers market unless I'm sure farmers market prices are competitive to Fred Meyers. Ref (2) above: Will require initial out lay of money to replace tank and juice 25\$? Quit using e cigarettes before because I got a sinus and ear infection I attribute to using the e cigarettes. resuming will require me to monitor ear and sinus health--see if I can quit both faster. Ref (3). Encourage Michael to a get job and slow down and relax a little, think safety on the road. Constraint: Michael rarely at home and available to speak to except odd hours or when he needs help.