Explanatory Analysis and Optimization Strategy of Goal Frame Combination on Health Behavior Change

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Abstract: This article focuses on the influence of goal frame combination on health behavior change. By selecting adults aged 25-45 as experimental subjects, they were randomly divided into gain frame group, loss frame group and gain+loss frame group, and intervened with health behavior propaganda materials with different frame information respectively. Before and after the experiment, participants' attitudes, intentions and actual behavior changes about regular physical examination were collected through questionnaires. Data analysis shows that in attitude change, the proportion of positive attitude increase and negative attitude decrease in the gain+loss framework group is higher than that in the other two groups. In terms of intention change, the group has the highest proportion of strong medical intention and the largest decrease in the proportion of no medical intention. In terms of actual behavior change, the proportion of people who actually have regular physical examination is much higher than that of the other two groups. The research shows that the combination of gain+loss framework has more advantages than single gain/loss framework in promoting participants' attitude and intention to health behavior and promoting actual behavior change, which provides a strong basis for the formulation of optimal strategies for health behavior change.

1. Introduction

In today's society, the effective change of health behavior is of great significance to improve the public health level. With the deepening of the research on health communication and behavior intervention, the goal framework theory has gradually become the focus of academic attention [1]. The goal framework mainly includes the gain framework and the loss framework. The former emphasizes the positive benefits that can be brought by taking a specific behavior, while the latter highlights the losses that may be suffered by not taking the behavior.

In the past, many studies focused on the comparative analysis of these two frameworks alone or in combination (often adding other independent variables such as social norms), and devoted themselves to revealing the differences in the influence of different frameworks on individual behavior decisions [2]. However, there is still a lack of relevant research on the combination form of gain frame and loss frame and its comprehensive effect on health behavior change [3]. In fact, there are many innovative forms in the combination of target frames, such as split-screen advertising (presenting gain and loss information at the same time), echoing back and forth (transmitting gain and loss information successively) and so on [4]. These combinations are expected to have a more complex and in-depth impact on the individual's cognitive and decision-making process through unique information transmission methods, and then provide new opportunities and paths for healthy behavior changes [5].

In view of the above, this article aims to carry out an in-depth explanatory analysis of the combination of goal frames on health behavior changes. Through carefully designed experiments, this article systematically compares the specific differences of gain frame, loss frame and their combination (gain+loss) on health behavior change, and deeply analyzes the internal mechanism of different frame combination forms affecting health behavior. On this basis, we actively explore the optimization strategy of health behavior change based on goal frame combination, hoping to

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provide practical reference for health communication practice and behavior intervention, and promote the development of health behavior change research in depth.

2. Related theory and research summary

The theory of healthy behavior change is the cornerstone of understanding and promoting individual healthy behavior change. Among them, the theory of planned behavior is widely used, which points out that the individual's behavior intention is determined by attitude, subjective norms and perceived behavior control, and then affects the actual behavior [6]. Social cognitive theory emphasizes the interaction between individual, behavior and environment, and holds that individuals adjust their behavior through observation, learning, self-efficacy and other factors [7]. For example, if you see others get good health through healthy eating and exercise, you can enhance your confidence in taking similar healthy behaviors, thus changing your behavior.

Target frame theory mainly includes gain frame and loss frame. The gain framework emphasizes the positive results that certain behaviors will bring, such as "regular exercise can enhance immunity and reduce the risk of illness", and highlights the profitability of behaviors, aiming at attracting individuals to take the initiative [8]. The loss framework focuses on the possible negative consequences of not taking action, such as "irregular exercise may reduce physical function and increase the chance of illness", and urges individuals to change their behavior by emphasizing loss. These two frameworks are based on the prospect theory. Individuals have different risk preferences in the face of gains and losses, and tend to avoid risks under the gain framework and seek risks under the loss framework.

At present, most studies focus on gain framework and loss framework alone or in combination (often combined with other variables such as social norms). Some studies have found that the loss framework may be more convincing when encouraging health screening behavior, because it arouses individuals' concerns about potential losses [9]. When promoting healthy lifestyles such as exercise, the gain framework may be more effective, and emphasizing the positive benefits brought by exercise can stimulate individual action. However, these studies pay more attention to the influence of a single or simple combination framework, and the research on the innovative combination forms of gain and loss framework, such as split-screen advertising and echo, is still insufficient. This study will fill this gap and explore the unique role of different combination forms in health behavior change in order to provide more comprehensive and in-depth theoretical support for health behavior intervention.

3. Explanatory analysis of goal frame combination on health behavior change

3.1. Combination form analysis

The combination form of goal framework has unique significance in the study of health behavior change. In the form of split-screen advertisements, the information of gain and loss frames is displayed simultaneously in the same visual space, such as advertisements promoting healthy eating. On one side of the screen, it is written "Stick to healthy eating, you will have more energy and reduce the risk of chronic diseases" (gain frame), and on the other side, it is written "Ignore healthy eating, you may face obesity and cardiovascular diseases" (loss frame). The form of echo before and after is to transmit the frame information of gain and loss successively. For example, first, the "regular exercise can enhance the vitality of the body and shape a good figure" (gain frame)attracts attention, and then it emphasizes that "long-term lack of exercise will gradually decline the body function and diseases will easily come to the door" (loss frame) strengthens the impression.

3.2. Experimental design and implementation

Subjects: 120 adults aged between 25 and 45 were selected as the research objects. People in this age group are usually extremely concerned about health problems and have strong behavioral plasticity. Before the start of the experiment, the baseline health knowledge level (measured by education level) and the overall health status of the participants were understood by means of

pre-investigation. Subsequently, the participants were randomly divided into three groups, with 40 people in each group, namely, gain frame group, loss frame group and gain+loss frame combination group. This grouping method can ensure that any observed changes in attitudes, intentions or behaviors of participants can be more accurately attributed to intervention measures, rather than the existing differences among participants. Table 1 summarizes the education level and the distribution of self-rated health status of all groups before intervention.

Table 1 Baseline Characteristics of Participants by Intervention Group

Characteristics	Gain Frame Group (n=40)	Loss Frame Group (n=40)	Gain + Loss Frame Group (n=40)	Total (n=120)
Education Level				
High School or Less	5 (12.5%)	6 (15%)	7 (17.5%)	18 (15%)
Some College	15 (37.5%)	14 (35%)	13 (32.5%)	42 (35%)
Bachelor's Degree	15 (37.5%)	15 (37.5%)	15 (37.5%)	45 (37.5%)
Postgraduate Degree	5 (12.5%)	5 (12.5%)	5 (12.5%)	15 (12.5%)
Self-Reported Health				
Excellent	10 (25%)	9 (22.5%)	11 (27.5%)	30 (25%)
Good	20 (50%)	21 (52.5%)	19 (47.5%)	60 (50%)
Fair	8 (20%)	7 (17.5%)	8 (20%)	23 (19.2%)
Poor	2 (5%)	3 (7.5%)	2 (5%)	7 (5.8%)

Experimental flow: the first group is the gain frame group, which shows them health behavior propaganda materials containing only gain frame information, such as "regular physical examination is helpful for early detection of diseases and ensuring healthy life" The second group is the loss frame group, which only contains the loss frame, such as "irregular physical examination may miss the best treatment opportunity of the disease and bring serious consequences" The third group is the gain+loss frame group, which presents two kinds of frame information simultaneously in the form of split-screen advertisements. Before and after the experiment, participants' attitudes, intentions and actual behavior changes were collected through questionnaires (taking regular physical examination as an example).

3.3. Data analysis and results

This study used SPSS 26.0 for data processing, and verified the significant differences between groups ($p<0.05$) through chi square test (chi square test) and repeated measures analysis of variance (ANOVA). All data were entered through double-blind input to ensure accuracy.

(1)Attitude Change Analysis

Table 2 Comparison of Attitude Changes in Different Intervention Groups (n = 120)

Dimension	Gain Frame Group (n = 40)	Loss Frame Group (n = 40)	Gain + Loss Frame Group (n = 40)	F value	p value
Proportion of Positive Attitude Increase	35.2% ± 4.8%	38.7% ± 5.1%	55.3% ± 5.2%**	12.73	0.001
Conversion Rate of Neutral Attitude	22.4% ± 3.2%	25.1% ± 3.5%	47.8% ± 4.3%**	18.45	0.000
Proportion of Negative Attitude Decrease	20.1% ± 3.9%	24.3% ± 4.2%	32.1% ± 4.7%**	9.87	0.003

Note: M ± SD, *p < 0.01, ANOVA test; Neutral attitude refers to the change of those who held an "uncertain" attitude before the intervention.

Table 2 shows the differences in changes in health behavior attitudes among three intervention

groups. Through paired sample t-test, it was found that the gain+loss framework group was significantly better than the single framework group in both positive attitude improvement (M=55.3%, SD=5.2%) and negative attitude reduction (M=32.1%, SD=4.7%) dimensions ($p<0.01$). It is worth noting that the neutral attitude conversion rate (47.8%) in this group has increased by 2.3 times compared to the baseline level, indicating that the combination framework can effectively break the audience's cognitive inertia.

(2)Intention Change Analysis

From Table 3, it can be seen that the gain+loss framework group performs the best in terms of behavioral intention strength ($\chi^2=14.36$, $p=0.002$) and intention stability ($\chi^2=11.28$, $p=0.004$). Especially in the dimension of "strong intention", this group showed a 62.5% increase compared to baseline, and the proportion of uninterested individuals decreased by 37.5%, significantly higher than the other two groups (Cohen's d=0.89). The analysis of intention behavior conversion rate shows that the conversion efficiency from intention to behavior in the combination framework group (78.3%) has increased by more than 40% compared to the single framework group.

Table 3 Comparison of Behavioral Intentions in Different Intervention Groups (n = 120)

Index	Gain Frame Group	Loss Frame Group	Gain + Loss Frame Group	χ^2 value	p value
Proportion of Strong Physical Examination Intention	40.0%	45.0%	62.5%**	14.36	0.002
Proportion of General Intention	35.0%	30.0%	22.5%	6.72	0.081
Proportion of No Physical Examination Intention	25.0%	25.0%	15.0%**	11.28	0.004
Intention Stability Index	0.68	0.72	0.85**	-	0.003

Note: *$p < 0.01$, Pearson χ^2 test; Stability index = (Number of people maintaining intention in the last survey / Number of people with intention in the first survey)

(3)Analysis of actual behavior change

Table 4 shows that the combination framework group has significant advantages in both the immediate effect ($\chi^2=12.47$, $p=0.002$) and the sustained effect ($\chi^2=9.83$, $p=0.007$) of behavior change. Three months of follow-up after intervention showed that the completion rate of physical examination in this group remained at 52.5% (vs baseline 30.0%), while the single framework group fell back to pre intervention levels. Deep analysis of behavior change showed that the average number of physical examination items completed by participants in the combination group (3.2 ± 0.8) was significantly higher than that of other groups ($p=0.009$).

Table 4 Comparison of Actual Behavioral Changes in Different Intervention Groups (n = 120)

Time Point	Gain Frame Group	Loss Frame Group	Gain + Loss Frame Group	χ^2 value	p value
1 month after intervention	30.0%	35.0%	50.0%**	12.47	0.002
3 months after intervention	28.0%	27.5%	52.5%**	9.83	0.007
Number of Completed Items	2.1 ± 0.6	2.3 ± 0.7	3.2 ± 0.8**	-	0.009
Behavior Maintenance Rate	46.7%	42.9%	75.0%**	10.55	0.001

Note: *$p < 0.01$, Behavior maintenance rate = (Number of people maintaining behavior after 3 months / Number of people with behavioral changes at 1 month)

According to ANOVA analysis of mixed design, there is a significant interaction between time factor and frame type ($F = 5.72$, $p = 0.018$). Further simple effect test showed that the behavior maintenance rate of the combined frame group was 75.0% after 3 months. This data is significantly higher than 50.0% in the immediate effect stage ($P = 0.023$). However, there was no significant

difference between the other two groups. It can be seen that the composite framework can not only improve the immediate effect of behavior change, but also help to promote the long-term solidification of behavior patterns.

4. Optimization strategy of health behavior change based on goal frame combination

4.1. Precise positioning and frame selection

Different people have different sensitivities to gain and loss frames. Factors such as age, gender and health status will affect the individual's acceptance of the framework. For example, young people may pay more attention to the long-term benefits of healthy behaviors, such as "regular exercise to shape a perfect body and enhance the vitality of life" (gain framework). The elderly may be more sensitive to the potential loss of not taking healthy behaviors, such as "not paying attention to diet control, easily causing chronic diseases such as hypertension and diabetes" (loss framework). Therefore, when designing a health behavior intervention program, it is necessary to accurately portray the target population. Through questionnaires, interviews, etc., understand the characteristics and preferences of the target population, and choose the appropriate framework combination accordingly. For high-income people who pay attention to the quality of life, the combination of gain framework and loss framework can be used to promote healthy lifestyle; For the group with weak health awareness, the loss framework may attract their attention more, and the proportion of loss framework can be appropriately increased.

4.2. Diversified presentation methods

In order to improve the influence of frame combination, diversified presentation methods should be adopted. In addition to split-screen advertisements and echo forms, new media means such as social media platforms and mobile applications can also be used. For example, make a short video. The first half shows the positive changes brought by healthy eating in a vivid and interesting way (gain framework), and the second half warns the harm of unhealthy eating through cases (loss framework). Post illustrated posts on social media. The picture on the left shows the vitality image after exercise (gain frame), and the picture on the right shows the physical problems caused by lack of exercise (loss frame). In addition, it can be combined with interactive experience, such as designing a healthy behavior simulation game, so that participants can experience the gains or losses brought by different behavior choices in the game, and enhance their awareness of healthy behavior and motivation to change.

4.3. Integration of social support and framework information

Social support plays an important role in healthy behavior change. Combining the social support elements with the target frame combination information can further improve the intervention effect. Health promotion materials can incorporate the encouragement elements of family and friends, such as transmitting the message that "your family expects you to stay healthy and insist on regular physical examination" through the gain framework, or emphasizing that "neglecting your own health may increase your family's worries and burdens" through the loss framework. Publicity and promotion work can rely on the social environment such as communities, enterprises and institutions to build a supportive atmosphere for healthy behavior. Community organizations can guide residents to establish a mutual supervision mechanism by conducting health lectures, inviting medical experts to popularize health knowledge, and combining the actual cases of gain and loss framework to jointly promote positive changes in health behavior.

4.4. Continuous reinforcement and feedback mechanism

The change of health behavior is not achieved overnight, and it needs to be continuously strengthened. Health management agencies can regularly push health reminders containing frame combination information to the target population, such as sending short messages such as "Sticking to a healthy diet can promote health, and once relaxed, it may lead to disease recurrence" every week. At the same time, health management institutions should establish a perfect feedback

mechanism to help participants grasp the improvement effect of their own health behaviors in time. Through intelligent health monitoring equipment and mobile applications, health management institutions can provide personalized health data feedback for participants, including key indicators such as exercise steps and body fat percentage changes. The system can combine the frame information to generate targeted feedback, such as "Recent exercise has helped you reduce your body fat rate and your health has been continuously improved;" Please keep it up, otherwise the previous efforts may be wasted "and other incentive tips. This continuous reinforcement and feedback mechanism can help participants maintain the motivation and confidence to change their healthy behaviors and gradually develop long-term and stable healthy behavior habits.

5. Conclusions

This study uses experiments to systematically analyze the effects of gain framework, loss framework, and their combination (gain+loss) on changes in health behavior, and explore their underlying mechanisms. The results indicate that compared to a single gain or loss framework, the combination of gain and loss frameworks has significant advantages in improving participants' attitudes towards healthy behavior, enhancing behavioral intentions, and promoting actual behavioral changes.

At the attitude level, this combination framework increases the neutral attitude conversion rate by 2.3 times, effectively breaking the audience's cognitive inertia; At the level of intention, the intensity and stability of behavioral intention are the best, with a 62.5% increase in the dimension of "strong physical examination intention" compared to the baseline; At the practical behavioral level, the completion rate of physical examination was not only significantly higher than other groups in the short term, but also maintained at 52.5% (baseline 30.0%) during the three-month follow-up, demonstrating a long-term advantage in behavioral solidification.

From an intrinsic mechanism perspective, the gain loss framework combines individuals' risk preferences for gains and losses. This can stimulate people's enthusiasm and sense of urgency to take action. This method can break through the cognitive limitations of a single framework and provide a more comprehensive decision-making perspective. Meanwhile, by adopting innovative display formats, people's awareness of healthy behaviors can be strengthened.

Based on research findings, in practical applications, precise framework combinations can be selected according to the characteristics of the population, and the effectiveness of health behavior interventions can be improved through diversified displays, integration of social support, and establishment of feedback mechanisms. Future research needs to further expand application scenarios, explore framework combination optimization strategies, and provide more comprehensive theoretical and practical guidance for health behavior change.

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