

Alzheimer's disease prevention through behavior change

The Gray Matters app

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# Smart Environments Research Group

# SERG

Smart Environments  
Research Group

The screenshot shows the SERG website homepage. At the top, it features the University of Ulster logo and the title 'Smart Environments Research Group'. Below this is a navigation menu with links for Home, About, Projects, People, Publications, Resources, News, Events, and Contact. The main content area includes a description of the group's location and facilities, a vision statement, and a strategy overview. There are also three tweets displayed on the right side of the page, each with a small image of a presentation slide. At the bottom, there is a banner for the 'UCAmi & IWAAL Conference 2014' held in Belfast from December 2nd to 5th.



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## Alzheimer's Disease (AD).

AD is a **global** health concern.

It is the most common cause of **dementia**.

Symptoms include loss of memory, confusion, mood changes and difficulty communicating and reasoning.

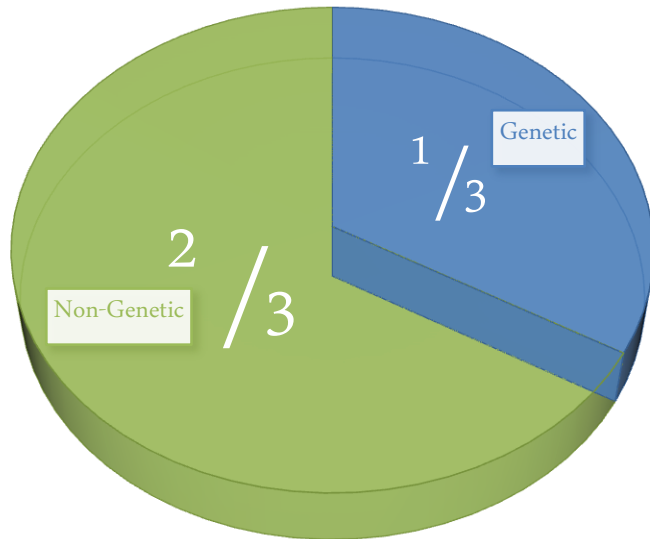
## AD may be preventable.

International experts agree that AD may be *preventable*, and have called for a concentrated effort to study *modifiable* risk factors.

[1]

1. Smith, a D., Yaffe, K.: Dementia (including Alzheimer's disease) can be prevented: statement supported by international experts. J. Alzheimers. Dis. 38, 699–703 (2014).

# Risk Factors



- All genetic factors of AD discovered to date account for approx. one third of the risk. [1]
- Non-genetic risks factors include: behavioural, social, environmental and educational factors.

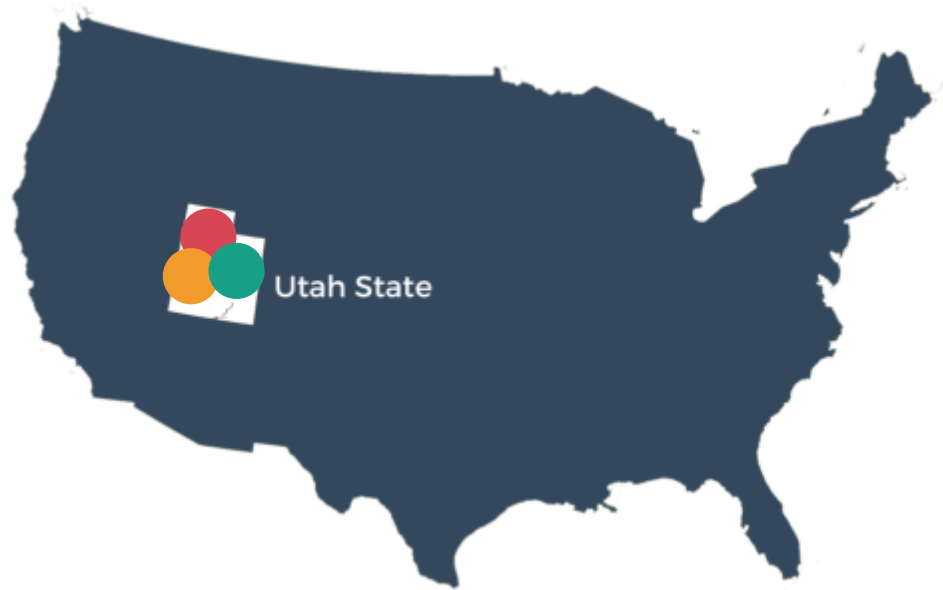
Most importantly,  
non-genetic risk factors are **modifiable**

## When to intervene?

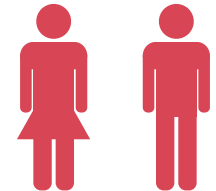
The neuropathological process involved in AD may begin **decades** before symptoms emerge.

In our study, we aimed to investigate multi-domain interventions within a middle aged population (40-64yrs).

# The Gray Matters Project



104 assigned to treatment group



## Intervention Program

To provide health education that summarised evidence-based lifestyle recommendations.



## Smartphone App

To deliver educational material, encourage engagement and track lifestyle behaviors.

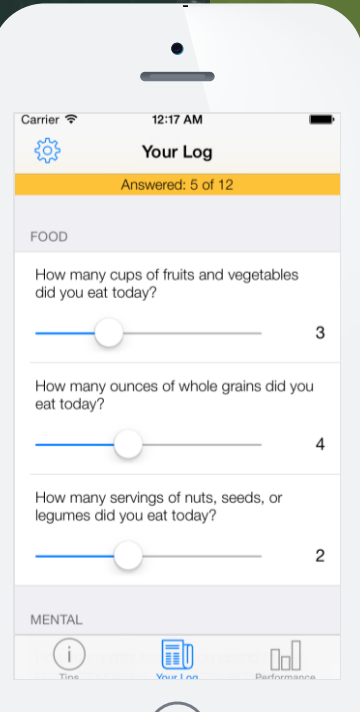


## Activity Monitor

Provided with a wearable wrist worn activity monitor - Nike Fuelband SE (donated by Nike)

# The Gray Matters App

An Overview



## PROVIDES A DAILY FACTOID AND SUGGESTION PAIR

Gives users a short snippet of text based on health literature about Alzheimer's disease. It then suggests a lifestyle change that could improve the likelihood of preventing AD.



## FACILITATES USER DATA ENTRY TO ENABLE LIFESTYLE TRACKING

Users answer 12 preset questions aimed to assess performance across 6 behavioural domains.



## PROVIDES REAL TIME PERFORMANCE FEEDBACK

Based on the users' answers, they are provided with visual feedback in the form of a 5 star rating for each domain. They can also see a weekly summary of their efforts.

“Aims to assess the effect of behavioral changes on the risk of developing AD, through the use of everyday technologies.”

# Gray Matters app

(Fact and Suggestion Pairs)

There are **164** fact and suggestion pairs Knowledgebase built upon evidence-based literature.

Based on **6 domains**:

1. Food
2. Physical
3. Cognitive
4. Social
5. Sleep
6. Stress



# Gray Matters app

(Fact and Suggestion Pairs)

The factoids are refreshed every 24hrs.

Example:

*“Consuming high amounts of processed foods is related to cognitive decline”*

*“Try a fresh salad for dinner instead of something from a box”.*

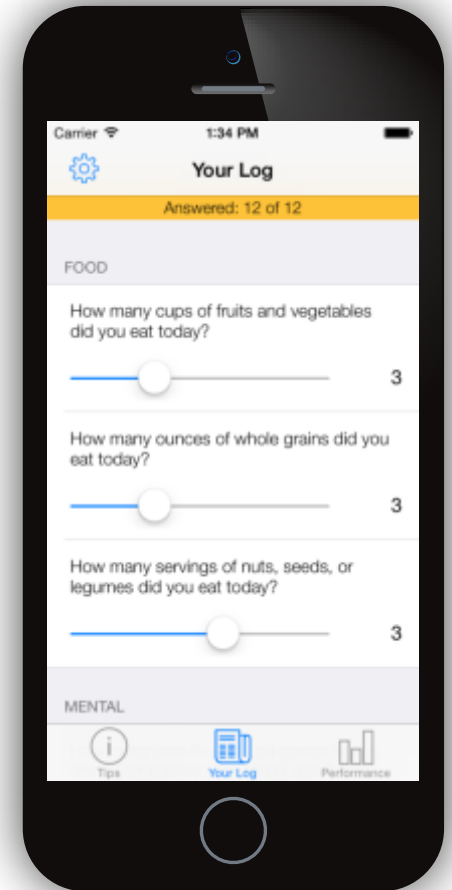


# Gray Matters app (Self-Report Behavior)

The users are asked 12 questions daily.

Each question:

- relates to a domain
- is fixed to a nominal scale
- has a recommended answer value based on WHO, CDC and AHF
- can be updated throughout the day



# Gray Matters app (Self-Report Behavior)

Self-reporting is performed using a fixed width slider for each question.

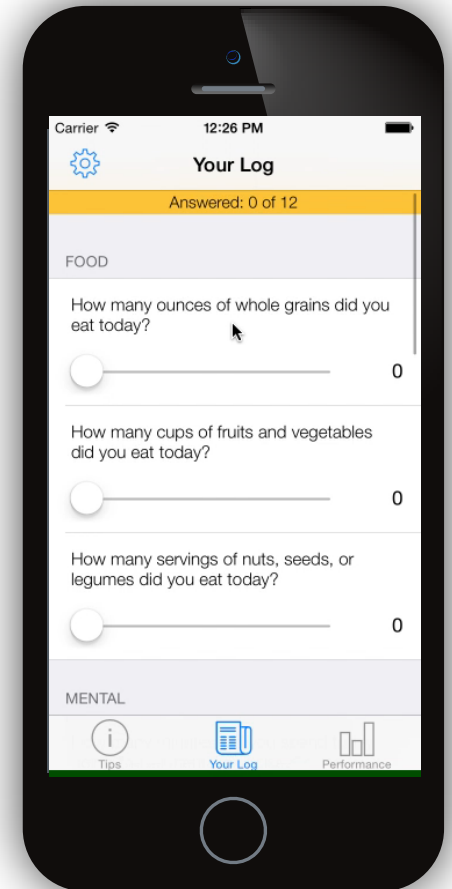
Using min, max and recommended values, performance can be calculated.

How many cups of fruits and vegetables did you eat today?



Recommended Value

3



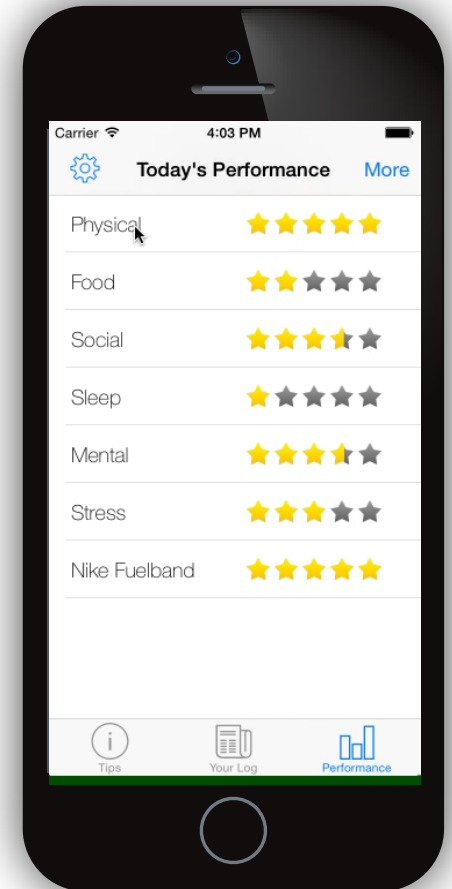
# Gray Matters app

(Performance Feedback)

The user is presented with a 5-star rating of their performance for the current day.

The stars are designed to **encourage** and **reinforce** the user's effort to change their behavior.

Users can also view a weekly summary of their performance.



## App Feature Summary

Enables the user to become **informed** about AD and personalised preventative measures they can take.

It also highlights, at a glance, which domains they can make the **most impact** in changing their lifestyle or behaviors.

# Results

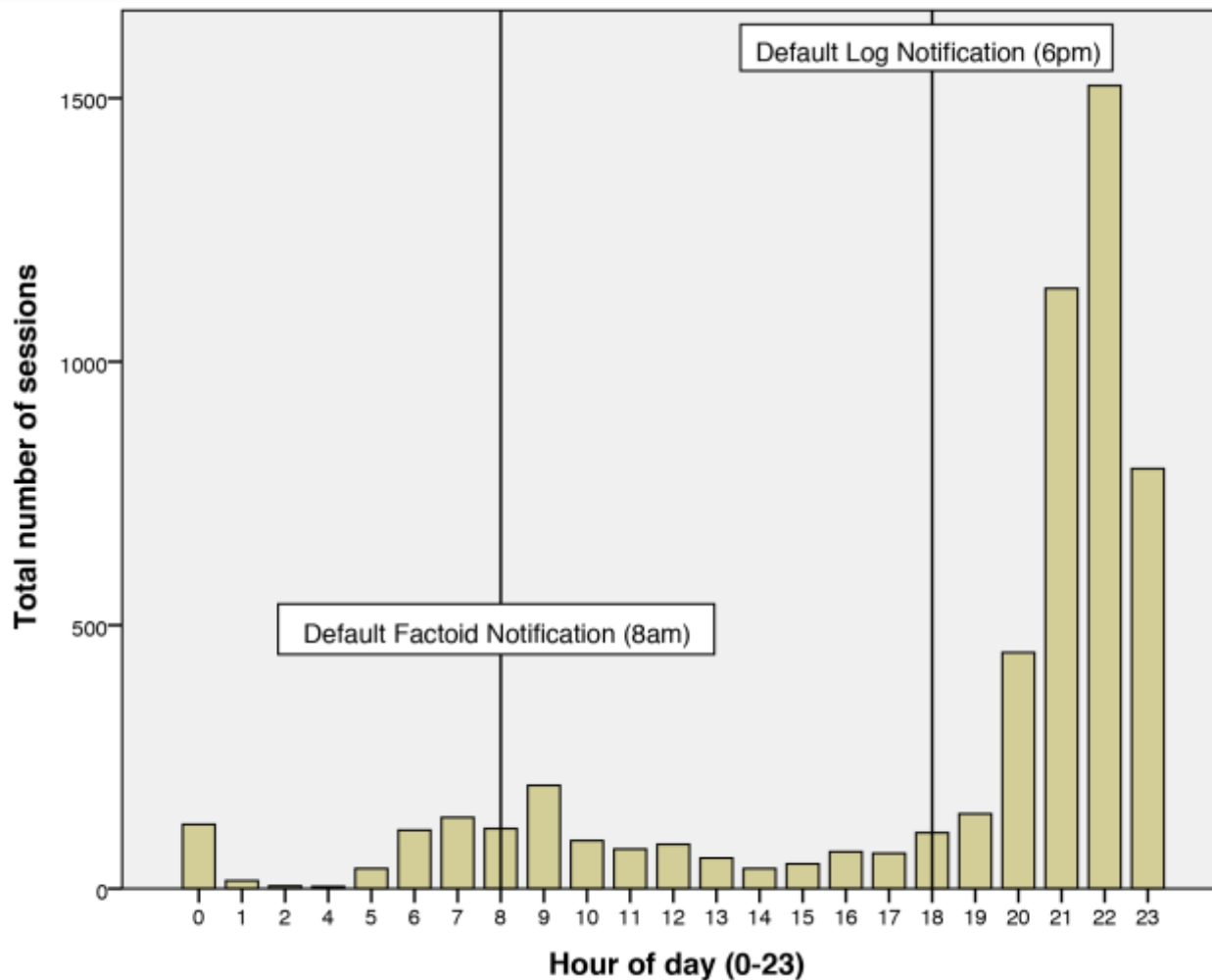
From the cohort in Cache County, Utah.



**122k+ responses logged**

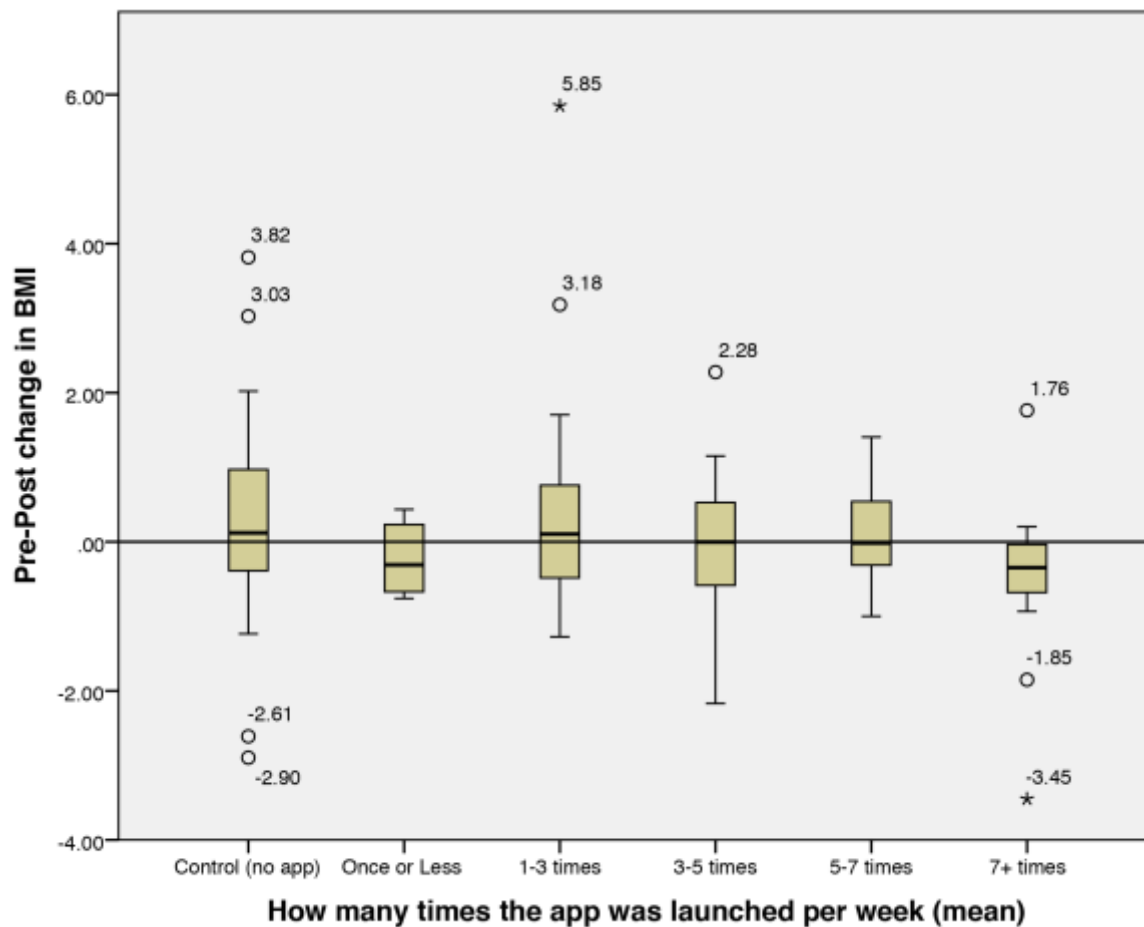
Exactly 122,719 behavioral logs were collected during the study.

# TOTAL NUMBER OF APP LAUNCHES AGAINST HOUR OF DAY (0-23)



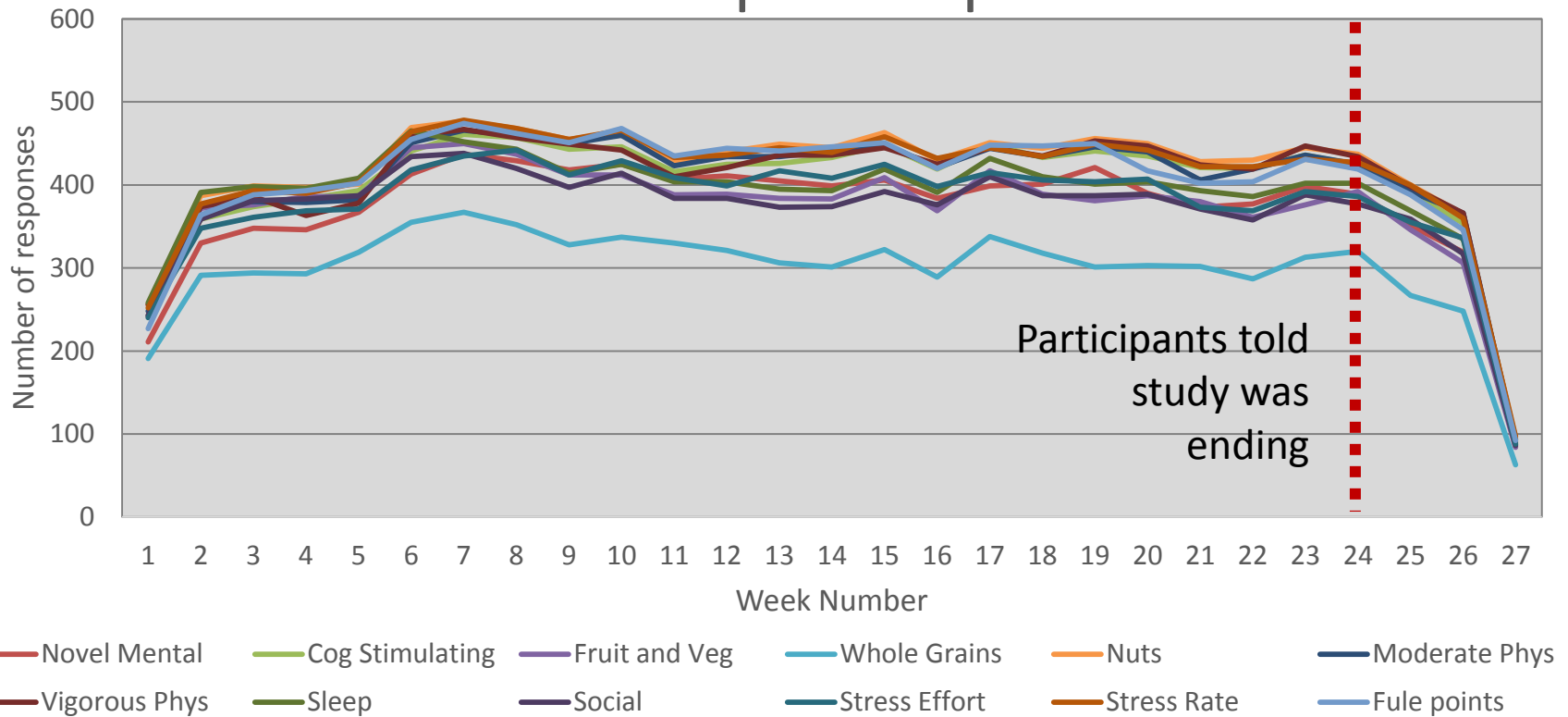
BOXPLOT SHOWING CONTROL (NO APP) AND TREATMENT (GROUPED BY APP LAUNCHES PER WEEK) AGAINST OBSERVED CHANGES IN BMI.

OUTLIERS ARE PLOTTED AS INDIVIDUAL POINTS.



# Sustained Engagement

## Number of responses per week



# Results Gray Matters

Over **122** thousand behavioural logs were collected during the study.

Treatment group (vs. control group) achieved significantly greater:

- **Increase** in intrinsic motivation (p=0.003)
- **Decrease** in concerns about memory (p=0.047)
- **Increase** in social engagement (p=0.001)
- **Increase** in Hdl cholesterol (p=0.043)

Influence of Technology

- **77%** felt app had at least some impact on health
- **50%** felt fuelband had at least some impact on health
- **85%** felt Fuelband made them more active.

# Summary

Next steps are to:

- take on board feedback from participants and update functionality on personalisation of app.
- evaluate in a more diverse population.
- make app more freely available on iOS and Android platforms.



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