Lighting up neural networks:
The brain's response to addressable ads

Thinking Inside the Box

Thinking
In 2007, Yankelovich, a leading Market Research firm, conducted a study which determined that the average person was exposed to around 5,000 advertisements each day. Fast forward to 2022, and many market researchers estimate the number to be as high as 10,000 ad impressions, per person, every single day. Why? That's why in 2020, we launched Thinking Inside the Box (TITB), a series of research projects to delve deeper into understanding how the TV landscape is evolving and what this means for advertisers.

F:NECAST

One way for brands to make themselves memorable is through addressable TV campaigns. Addressable TV campaigns allow brands to show different ads to different households while they're watching professionally produced TV content. We're proud of the positive results our clients achieve in brand awareness, consideration, website traffic, sales, etc. when running addressable TV campaigns with us. We're excited to share these results with you. We regularly publish case studies highlighting the positive results our clients achieve in brand awareness, consideration, website traffic, sales, etc. when running addressable TV campaigns. We're always looking for new ways to help our clients achieve their goals.

That's why in 2020, we launched Thinking Inside the Box (TITB), a series of research projects to delve deeper into understanding how the TV landscape is evolving and what this means for advertisers. TITB helps brands to make their messages memorable in a world where the average person is exposed to 10,000 advertisements each day. With that being the case, how can you stand out? How can you create a lasting impression on your customers? What does it mean to be attention-grabbing in a sea of noise? How can you make your message stand out among the thousands of others?

One way for brands to make their messages memorable is through addressable TV campaigns. Addressable TV allows brands to show different ads to different households while they're watching professionally produced TV content. We're proud of the positive results our clients achieve in brand awareness, consideration, website traffic, sales, etc. when running addressable TV campaigns. We're always looking for new ways to help our clients achieve their goals.

That's why in 2020, we launched Thinking Inside the Box (TITB), a series of research projects to delve deeper into understanding how the TV landscape is evolving and what this means for advertisers. TITB helps brands to make their messages memorable in a world where the average person is exposed to 10,000 advertisements each day. With that being the case, how can you stand out? How can you create a lasting impression on your customers? What does it mean to be attention-grabbing in a sea of noise? How can you make your message stand out among the thousands of others?
We'd love to tell you.
Want to know more?

Phases one through four of our TITB series included ethnography sessions with TV viewers and their opinion on TV advertising today and how it's changed, interviews with industry leaders and neuroscience experiments with UCL professors to understand how viewers respond to TV ads in different contexts, research into brand perception and viewer engagement, and finally, research into what factors drive attention. To answer these questions, we partnered with professors of neuroscience from University College London (UCL) to carry out two experiments.

Our latest study, and phase five of our TITB research, sought to investigate why addressable TV is so effective. We teamed up with UCL professors to carry out two experiments exploring the impact of addressable ads. The outcomes of the study were impressive and have significant implications for the media industry. They shed light on why addressable TV campaigns continue to achieve substantial results for clients, and they provide further evidence that addressable TV campaigns deliver a strategic advantage to brands who include this technology in their media plans. They also provide evidence that addressable TV campaigns deliver a strategic advantage to brands who include this technology in their media plans.

Our latest study and phase five of our TITB research, sought to

Find out more
Key findings

Addressable ads produce greater brain activity in four key networks relating to:

- Addressable ads are recalled faster and more easily than non-addressable ads
- Addressable ads are recalled better in any context, i.e., whether participants choose the show or not
- Factors such as age and choice of content impact strength of recall

The experiments

To investigate how the brain responds to addressable ads, we carried out two experiments. The first took place in the UCL lab with 24 participants who had their brain activity recorded by fMRI while watching TV shows with ads that were either related to their interests (addressable) or not. This first experiment studied what addressable content (addressable) or not. This first experiment studied what cognitive and neurological mechanisms were activated by addressable content.

The second experiment was conducted with 200 pre-screened participants online. These participants were shown the same content and their memory and recall for addressable content was measured using an online behavioral survey. This second experiment was designed to measure what impact addressable TV ads have on participants’ memory and recall of relevant content.
Experiment One: Brain response to addressable vs. non-addressable ads

The first experiment looked at what impact addressable ads have on brain activity. Previous research has demonstrated that people both prefer and remember addressable ads more than non-addressable ads (TITB, Phases 1-3), and in this experiment we sought to establish whether addressable ads have an impact on brain activity. The study looked at what happens in key brain regions while a person watches TV and is exposed to addressable and non-addressable ads. This study looked at four strategic areas associated with:

- **Attention**: People don’t remember ads that they don’t pay attention to.
- **Emotion**: Ads that evoke emotions tend to be more readily remembered.
- **Reward**: When reward centers of the brain are activated, people feel good and associate that good feeling with your brand.
- **Memory**: For an ad to be effective it must be memorable.

In-person experiments were conducted using an fMRI machine to scan participants’ brains. This study looked at what happens in key brain regions while a person watches TV and is exposed to addressable and non-addressable ads. We looked at four strategic areas associated with:

- **Attention**: People don’t remember ads that they don’t pay attention to.
- **Emotion**: Ads that evoke emotions tend to be more readily remembered.
- **Reward**: When reward centers of the brain are activated, people feel good and associate that good feeling with your brand.
- **Memory**: For an ad to be effective it must be memorable.
Participants:

To select participants, a pre-screening survey was sent to 304 people in the London area that asked about their interest in a variety of items including the four ad categories that would be part of the experiment. Responses were statistically analysed to account for response bias and to find participants with interest in two, and only two, of the ad categories featured in the experiment. This resulted in 102 potential participants who fell into one of the six categories below (Figure 1).

Twenty-four people took part in the experiment. There were exactly four volunteers from each of the six participant profiles, ensuring perfect balance across ad-relevance profiles. The demographics of the group were as follows:

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-34</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>35-54</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>55+</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

The experiment:

Participants watched a 30-minute TV episode with embedded ads that addressed and non-addressable ads. Participants watched a 30-minute TV episode with embedded ads that addressed and non-addressable ads. The short scans were designed to localize brain activity associated with attention, reward, and memory, whereas the main experiment measured brain activity in each of the four networks while participants watched the show they watched during the first visit. Since the two participant profiles were varied during the first visit, all of the participants were exposed to both addressable and non-addressable ads. To enhance the reliability of the results, conditions at each of the two participant visits were varied. During the first visit, half of the participants chose the show they watched, while the other half were selected by a computer; on the second visit, the conditions were reversed. This allowed researchers to compare how participants responded to addressable and non-addressable ads under both conditions (self-selected vs. other-selected).

At the end of the second scanning session, all participants received a five-minute structural scan to identify their underlying brain anatomy, and all were found to be neurologically normal adults.

Participants: 24

<table>
<thead>
<tr>
<th>Auto</th>
<th>Travel</th>
<th>Pets</th>
<th>Gaming</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Participant profiles showing the two, and only two, categories of ads a selected participant expressed interest in.
Results

Addressable ads showed an advantage over non-addressable ads in all four brain networks relating to: attention, emotion, reward and memory. This is consistent with previous research (TITB, Phases 1-3) and suggests that multiple brain systems contribute to the addressability uplift effect.

Interestingly, addressable ads provoked a stronger response than non-addressable ads regardless of whether the participant chose the TV show or not. This is encouraging because it suggests that addressable ads are effective whether you’re the person holding the remote or not.

There are no numbers on the fMRI plots because the data is represented as differences in statistical distributions – what matters is the relation between the numbers. fMRI measures changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

Addressable ads showed an advantage over non-addressable ads and from the TV show they were watching. This is consistent with previous research (TITB, Phases 1-3) and suggests that multiple brain systems contribute to the addressability uplift effect.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

There are no numbers on the fMRI plots because the data is represented as differences in statistical distributions – what matters is the relation between the numbers. fMRI measures changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.

In the experiment, we measured the BOLD signal from addressable ads to assess changes in blood oxygen levels (which we call BOLD signal) which vary enormously from person to person and even session to session. As a result, instead we measure relative changes. In this experiment, for instance, we measured the BOLD signal from addressable ads, non-addressable ads, and from the TV show they were watching.
Lighting up neural networks: The brain’s response to addressable ads

Emotion

This experiment measured emotion-related brain activity in the amygdala (Figure 5). When comparing activity in this region during ads (both addressable and non-addressable) vs. the TV show, there was more activity in the amygdala during the TV show (as indicated by the shorter/less substantial drop-off in emotional response during an addressable vs. non-addressable ad). The uplift in activity was greater during addressable ads, with brain activity being closer to levels observed during the TV show. This is unsurprising given that the longer narrative form of the TV show facilitates greater emotional engagement than the shorter ads.

However, when comparing activity in the amygdala during addressable vs. non-addressable ads, the uplift in activity was greater during addressable ads, with brain activity being closer to levels observed during the TV show (as indicated by the shorter/less substantial drop-off in emotional response during an addressable ad). This demonstrates that addressable ads are more rewarding to the viewer than non-addressable ads.

Reward

As you’ll see in Figure 8, all ads (both addressable and non-addressable) produced less brain activity relative to watching a TV show (Figure 6). Overall, ads were less rewarding than watching a TV show (Figure 7). However, when comparing activity in the ventral striatum (image in Figure 7), there was more activity in the ventral striatum during addressable ads than during non-addressable ads, indicating greater reward-related activity during addressable ads. The downward direction of the bars in Figure 8 indicates the impact of ads on reward-related activity, with addressable ads producing a less substantial drop-off in reward activity (vs. the TV show) during an addressable ad and a more substantial drop in activity during a non-addressable ad. This demonstrates that addressable ads are more rewarding to the viewer than non-addressable ads.
Lighting up neural networks: 
The brain's response to addressable ads

---

**Figure 10:** Hippocampus: area of the brain which plays a major role in learning and memory.

**Figure 11:** Chart showing a minimal drop in memory-related activity relative to TV show levels during addressable ads and a substantial drop in memory-related activity during non-addressable ads.

The final analysis in this experiment looked at brain activity associated with making memories, as indicated by activity in the hippocampus (Figure 10). This study found that, in terms of memory, there is a clear advantage of addressable ads over non-addressable ads. Figure 11 shows a minimal drop in memory-related activity during addressable ads and a substantial drop in memory-related activity during non-addressable ads.
Experiment Two: Behavioural testing of addressable content:

Memory and recall

Previous phases of our research (TITB, Phases 1-3) demonstrated that there were marked increases in memory and recall for addressable ads. In this experiment, we sought to replicate these results with a different sample of new participants and a different set of ads to further ensure the validity and robustness of the original study (Open Science Collaboration, 2015).

An initial pre-screening survey was sent out to 1,000 UK-based participants. The demographic data was as follows:

- 100 Female
- 100 Male
- 40% Aged 18 – 34
- 45% Aged 35 – 54
- 15% Aged 55 – 70
- 40% Aged 18 – 34

Figure 1: The demographics of the participants who were selected to participate in this experiment.

Participants fitted into one of the six profiles previously referred to in Experiment One (Figure 1). We then selected a subset of 200 participants such that each profile had an equal number of participants, and that each gender had an equal number of participants. This ensured that the selection was representative of the wider population of UK-based participants. The results of this selection led to 200 suitable candidates who were invited to participate in this experiment.
Lighting up neural networks: The brain's response to addressable ads

The experiment

Once screened for suitability, participants were randomly assigned into either the choice condition (where they chose which TV show to watch during the study) or the random condition (in which the TV show was randomly selected for them). Participants then watched four ads (one from each of our four selected categories: auto, travel, pets, and gaming), followed by six minutes of the TV show. This cycle was repeated four times so that participants viewed a total of 16 ads, four from each of the four categories. These ads were presented in fully randomised order.

After viewing, participants were shown an image and asked to identify, as quickly as possible, whether they had seen it in one of the ads. Half of the images they were shown were from the ads in the study, while the other half were not. Participants were also asked to rate how much they liked each of the ads.

Results

Checking accuracy of participant recruitment

First, we conducted a manipulation check to confirm that our pre-screen survey correctly recruited people according to their interests. The results of this check (including Bayesian mixed models on these and all behavioural results) indicated that there were strong differences in the addressable and non-addressable conditions. These differences were significant for four of our conditions (Figure 12). A chart demonstrating the difference in participant interest in each of the four ad categories, split by addressability, is shown in Figure 12. The bars represent the average interest level of participants based on whether the category was addressable for them (pink) or not (green). The percentages represent the degree to which we can be confident that there are differences between the two conditions. The error bars represent the standard error of the mean. The width of the violin graphic demonstrates the distribution of responses, wider equals more responses. The top border of each box runs through the mean score of each category, and the width of the violin at this point demonstrates the degree to which the participant interest differs between the two conditions.
Once we had the above evidence that confirmed our participants were split into accurate conditions, we could move ahead with showing ads and measuring their responses based on whether an ad was addressable for them or not. Our next measurement showed that, overall, participants reported liking addressable ads much more than non-addressable ads across all categories (Figure 13).

**Figure 13**: Chart showing the degree to which participants liked ads that were addressable (pink) and non-addressable (blue). A “0” rating represents the average liking score that participants gave to all ads. The percentages, as in Figure 12, represent the degree of accuracy, while the pink and blue boxes within each violin graphic show the degree to which an ad was liked or disliked. The results for “All ads” on the far left, for example, shows a 1-point increase in liking for addressable ads overall, a decrease in liking for non-addressable ads (the downward direction of the box moving below 0) and a 100% confidence rating in the accuracy of the participants’ feedback. In Figure 12, a “0” rating represents the average liking score that participants gave to all ads.

## Implicit Measurements

So far, the explicit judgements of the participants were in line with what we could predict for addressable ads. But what about their implicit cognition and behaviour? To measure this, we tested whether speed and accuracy changed when an ad was addressable for each participant, whether speed and/or accuracy changed depending on the ad category, and whether memory was enhanced when an ad was addressable. Our next measurement showed that participants reported liking addressable ads much more than non-addressable ads across all categories (Figure 13).
Lighting up neural networks:
The brain’s response to addressable ads

With a larger sample size, this is an interesting finding to investigate in a future study. The brain’s response to addressable content was measured better for addressable content than for non-addressable content. This suggests that addressable content is processed differently from non-addressable content. In addition, this finding is consistent with previous research that has shown differences in neural activity between addressable and non-addressable stimuli.

We further investigated the results reported above by interrogating the effects of context and age. First, we looked at what happens when participants choose the TV show for themselves. In this case, participants of all ages generally remember addressable content better, as illustrated by the higher addressable line on the graph. Regions shaded in grey indicate ages where there was no statistically significant difference between addressable and non-addressable content. This is an interesting finding to investigate in a future study with a larger sample size.

Participants’ ability to correctly remember ads was roughly 10% higher for addressable content than for non-addressable content (Figure 14). This was calculated using a measure of accuracy called d’-prime, which considers participants’ correct recall of addressable content. The results also showed that participants were encoding addressable ads into their long-term memory more effectively, therefore reacting faster and more confidently to the content.
Lighting up neural networks: The brain’s response to addressable ads

Memory accuracy for ads, based on context and age, when show is randomly selected.

Results also showed that memory for non-addressable ads improved as people aged when the show was randomly selected. The results demonstrated that when participants were shown a TV show randomly selected by the computer, memory for addressable content is consistently better than for non-addressable content and is relatively stable across all ages (Figure 16).

Figure 16: Chart showing memory for addressable and non-addressable ads across different ages. The line for addressable ads (blue) consistently shows a higher memory accuracy than the non-addressable ads (red) across all ages.
Like our previous studies (TITB, Phases 1-3), the results of this research reveal compelling insights into the effectiveness of addressable TV.

The data collected in this study reveal that addressable ads:

- Garner greater attention from viewers
- Are more emotionally engaging
- Elicit more reward activity in the brain
- Are encoded into memory more effectively

Conclusion
Why does this matter for advertisers?

In the world of media and advertising, brands are competing for a limited and extremely valuable resource: attention. With an infinite number of channels to choose from, it’s important to know the greatest return on investment and the most trusted advertising medium.

Why does this matter for advertisers?

If you haven’t invested in addressable TV with Finecast yet, what are you waiting for? Make 2023 the year your brand gets on TV. If you’ve seen the power of addressable TV, then you know how powerful it can be. If you haven’t, you’re missing out on the greatest return on investment.

This means that when you run ad campaigns, you can rest assured that not only will the planning and targeting capabilities help you achieve the desired results, but also that, when these efforts are combined with the right creative, the audience will pay attention and the most memorable ad will draw more attention and the most meaningful brand message. With an infinite number of channels to choose from, it’s important to know the greatest return on investment.

Finecast provides advertisers a single point of access to the addressable TV ecosystem so they can reach their target audiences on the right screen, at the right time, with the right message, providing the optimal environment for driving positive results.

Time and again, TV has been rated as the most trusted advertising medium, and research continually demonstrates that addressable ads draw more attention and the most meaningful brand messages. It’s not just about reach above and beyond traditional linear TV advertising; it’s about ensuring that your brand is delivered in a way that resonates with your audience and drives action.

If you haven’t invested in addressable TV with Finecast yet, what are you waiting for? Make 2023 the year your brand gets on TV.
Thank you

To review previous research and keep updated with future projects, please visit www.finecast.com.