RESEARCH ARTICLE

Smoking behavior intervention based on implicit approach: a cross-sectional pilot study [version 1; peer review: awaiting peer review]

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Abstract

Introduction: Indonesia is the country with the highest smoking rate in Southeast Asia and the third-highest globally. Smoking has become one of Indonesia's biggest addiction problems. The goal of this research is to develop smoking behavior intervention based on an implicit approach.

Methods: This article contains a two-step study that was part of a comprehensive study on smoking behavior in Indonesia. The first study, applying measurement of Stroop task to 117 male-university-students with results revealed that smoking behavior was associated with attention bias. This result is the basis for developing an implicit approach-based intervention. In the second study, the research aims to develop an intervention by investigating the effects of the experimental retraining by manipulating the automatic-avoidance-action tendencies using an approach-avoidance task (AAT) on 40 male university student smokers that proved to have an attentional bias in the first study.

Results: The outcomes of the studies showed that the retraining (six weeks, twice a week) proved to shape the AAT effect and reduce the cigarettes consumption of the smokers. This pilot research becomes initial step to develop smoking cessation interventions in Indonesia using an implicit cognition approach.

Keywords

Smoking, attentional bias, Stroop Task, approach-avoidance task, implicit cognition, retraining

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Approval Status: AWAITING PEER REVIEW

Any reports and responses or comments on the article can be found at the end of the article.
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Introduction

Smoking has become one of the major addiction problems in Indonesia. As the highest country with the smoking rate in Southeast Asia and the third highest in the world, Indonesia is still facing unsolved smoking problems. Smoking is an addictive behavior. Today, smoking cigarette is one of the biggest addictive behavior problems, especially in Indonesia. In Indonesia, smoking behavior among youth has increased by almost 144%, which can be a problem for the Indonesian youth. As addictive behavior, smoking is really dangerous for health, psychological, educational, and financial life. Smoking intervention applied today is only given as explicit information due to gaining health awareness. The most common intervention in Indonesia was the cigarette smoking hazard campaign. But still, 86% of smokers smoke even if they know about the smoking hazard. This suggests that the intervention in Indonesia was not successful in reducing smoking behavior.

The implicit approach appears as an alternative that is in need. One of the new approaches to shaping cognitive behavior is the implicit approach. This approach gives attention to associative and unconscious factors. The implicit approach succeeded in Europe and the United States. The main concept is to build intervention to train implicit behavior as an automatic behavior form. Smoking as an addictive behavior has been proved caused by implicit association factor and could be trained to reduce by implicit approach. This research tried to develop an alternative smoking intervention based on an implicit approach that has never been applied in Indonesia.

First, the study aimed to measure attentional bias among smokers using the Stroop task to prove that smoking addiction is because of strong implicit association from the comparison between smokers and nonsmokers. The second step of this pilot study was to develop and apply implicit intervention using retraining approach-avoidance task (AAT) as an intervention to shape smoking-avoidance behavior. A two-step study can be illustrated in the following flow chart (Figure 1).

Methods

The present pilot research aimed to measure and develop an intervention for smoking behavior in the Indonesian population. This study is broken down into two distinct phases. The first phase was conducted over a week which succeeded in recruiting a number of participants both smokers and nonsmokers. The measurement of Study 1 was carried out within two weeks of early February 2020 in a laboratory setting. From the results of study 1, it was found that participants were able to participate in the intervention in study 2. The implementation of study 2 for 6 weeks after the implementation of study 1.

The first phase is measuring attentional bias using a smoking Stroop task in the Indonesian language to prove that smoking addiction is because of a strong implicit association from the comparison between smokers and nonsmokers in Indonesia. The main concept of developing an intervention to implicit behavior is to prove that implicit factors shape smoking behavior. One of the factors that sustains addictive behaviors is attention bias. Various research results have shown that attention bias affects smoking behavior among smokers.

The second step of this pilot study was to develop and apply implicit intervention using retraining AAT as an intervention to shape smoking-avoidance behavior in an experimental laboratory setting. The main concept of the second phase of the study was to develop an implicit intervention for smokers based on the results of the first phase. Implicit approach intervention was based on the approach-avoidance concept. The effort to adopt an implicit intervention is by investigating the effects of the experimentally-retraining using AAT. AAT is designed both for measurement and also as a form of intervention. AAT’s form of intervention is to manipulate and form automatic-avoidance-action tendencies. These studies were performed in conformity with the guideline of the Declaration of Helsinki. These studies involving human participants were reviewed and approved by the Universitas Islam Bandung Academic Ethics Committee (Ethical
Approval Letter Number: 710/B.04/Bak-k/XII/2020). All participants provided their written informed consent for conducting and publication of this research.

**Study 1**

Study 1 was conducted with 117 participants with 65 smokers and 52 nonsmokers (Mean Age=21.74 years, SD=0.82). For each group of participants, the researcher limits the minimum number of participants to 50 people, which is the number of participants considered sufficient. Inclusion criteria for all participants are male college students aged in late adolescents (age 18-22), with criteria for grouping participants as smokers was if they routinely smoke at least ten cigarettes/day. Inclusion criteria for nonsmoker participants was not smoking for at least two years in a row before this study. The exclusion criteria used for participants required that participants were not color blind nor have a brain injury, not using addictive substances. None of the participants included suffered from any disease, disability, or condition that might make the experimental tasks objectively difficult.

**Participant Recruitment Process**

All participants were recruited to the study through open recruitment which was announced on the campus social media. Researchers found that male smokers were the easier demographic to obtain. For nonsmoker participants, we also conduct direct recruitment of class leaders who giving text messages announcement to participants candidate according to the nonsmoker criteria. No coercion to take part in the study was used and participants will be involved only if they are interested. All participants who were willing to be part of the experiment registered themselves with the contact person (head researcher) in the announcement. Confidentiality of participant data is maintained and only known by the main contact. All scheduled participants are ensured according to the criteria.

All participants who registered were directed to come to the psychology laboratory the study was performed every four weeks. From the initial recruitment the study registered 153 participants but there were 36 people who failed to participate in the study due to various obstacles such as schedule conflicts, usually the condition of the conflict between the class schedule and the measurement, the condition of the participant who suddenly gets sick or has a sudden business that cancels participation in this study. All of the participants provided written informed consent and completed the smoking habit survey to categorize the smoking level of participants (light: 10 cigarettes/day; moderate: 11-20 cigarettes/day; heavy: more than 20 cigarettes/day). For smoker participants, they also fill out a letter of willingness to take part in the intervention study if needed (Study 2). All Stroop task are conducted in a laboratory setting with control environment such as room’s lighting and temperature with comfortable room settings. After conducting the Stroop task and debriefing, they get compensation for snacks and drinks after completing all measurement procedures.

**Smoking Stroop Task Development**

In this first study, the instruments used was the smoking Stroop task that was developed by the authors in Indonesian language to measure the smoking-behavior attention bias among participants. Stroop task was chosen for this study as it is one of the most commonly used measures of attentional bias. The Stroop task procedure is a test in which words appear one by one in the middle of the screen. Research participants were asked to press certain buttons according to the colors that appeared without thinking about the words listed on the screen. The Stroop task was completed by the participants using a laptop computer with 15 inches and conducting by software of Inquisit LAB 4.0.2.0 software (Millisecond Software, US, RRID:SCR_022151), software from the website that installed to the laptop. To run stroop task, are also free alternative software to run stroop task script such as DMDX. The researchers also determine each color that appears and the two buttons that must be pressed, namely the A or L button for a certain color using the index finger of the right hand on the L button and the index finger of the left hand on the A button. Only one index finger is used because the index finger is the easiest finger to use to press keyboard keys. The A and L keys are selected also considering the location of the two letters in the middle row and each at the left-right end of the laptop keyboard. This procedure was tested and has gone through expert validation conducted by researchers before being carried out.

The Stroop task running with five fixed colors (red, blue, green, yellow and purple) for participants to learn. Research participants were given four color options for each task. The first session is used as an example with color words. The word combinations of words and colors can match or differ. For example, the test may say the word yellow, even though it's written in red color. The task for the participant is to pay attention to the color, not the word.

The following smoking questions of the Stroop task were color answer choices divided into five sessions with fixed different color combinations. The participants performed the Stroop task immediately after the exercise session with the same principle as the practice. During the Stroop task, the researcher only supplied four color choices in each session so
that the participant did not experience difficulties in answering and so that the participant's attention was not disturbed by
the many color choices because the more color choices, the more buttons would be needed to answer.

The order of the combination of answers has been pre-determined and given in a non-sequential manner so that it
seems that it has undergone randomization (pseudorandomized). This procedure aims to avoid the learning process of
the participant. When the participants worked on the next section, they returned to their original condition without
memorizing the color answer choices in the previous section. In the smoking Stroop task, we measured differences in the
reaction of two groups of words that appear on the screen, namely words related to smoking word stimuli (e.g smoking,
ashtray, cigarette butt, etc) and neutral word stimuli (e.g house, umbrella, mountains, etc). There are 12 words in each
group with similar lengths and sounds. All of the words had been surveyed, analyzed and approved by an Indonesian
language expert. Figure 2 is an illustration of the Stroop task screen which has been translated into English. Participants in
the study actually looked at the screen in Indonesian language.

**Stroop Task Measurement**

The Stroop Task measured reaction time of the participants milliseconds (ms). The reaction time data was obtained from
time between the word appearing in the Stroop task until the participant presses the answer button. The milliseconds data
was collected automatically in the Inquisit Lab software in which Stroop task is performed. The maximum duration of the
Stroop task was 10 minutes.

In this study, the research aims to measure attentional bias using Smoking Stroop task data. Data Stroop task can provide
results that prove that smoking addiction based on presumption that strong implicit association can be obtained from the
comparison between smokers and nonsmokers. If the smoker's reaction time is longer than a nonsmoker, we can conclude
smokers have attentional bias. Analysis of variance (ANOVA) is applied to the results to investigate which participant
may have an attentional bias to smoking-related stimuli only and not neutral word stimuli. The data saved from the
installed software was stored in ratio scales (milliseconds).

Data is considered valid if three criteria were met. First, if reaction time is between 200 ms-5000 ms, this is normal range
for participants to answer. If reaction time is less than <200ms, it considered invalid answers because it means too quick to
answer without paying attention to the task. Data was also considered invalid if the reaction time was more than >5000 ms
because this suggests the participant was thinking too much and is no longer automatic response. Second, data with more
than 2 SD (standard deviation) was also discarded because it is considered abnormal data. Third, the error answer must
less than 20% to be considered normal and the data does not contain any major errors. The reaction data from the Stroop
task was analyzed using ANOVA. All data results were processed and analyzed using Official SPSS 23.0 belongs to
laboratory when conducting this study (IBM corporation, 2015, RRID:SCR_002865).

**Study 2**

In Study 2, all participants were obtained from the recruitment results of study 1. There were 52 participants that proved to
have an attentional bias get contacted for further study. They were briefed on the longer duration of second study
(6 weeks) and they were included in the study if they committed to all procedures needed. We obtained 40 smoker
participants (Mean Age=21.74; SD=.82) who are willing to participate in the intervention activities of study 2. They were
divided randomly into 2 groups, the experimental and control groups. The experimental group consisted of 24 smoker participants and control group consisted of 16 smoker participants. All experimental AAT intervention was conducted in a laboratory setting for 12 session (twice per week). During the retraining weeks, all participants completely filling smoking survey that monitors the number of cigarettes consumed each day that collected by researcher team. For the control group, they were informed that the daily smoking survey is the form of intervention that is given in the study. This detail was added so that participant in control group feel they are being treated. In experimental group, the participants divided into 2 types of intervention based on the form of AAT given, direct or indirect AAT. Explanation of the procedure for each form of AAT will be discussed later. In Table 1, the division of the participants can be seen for Study 2:

<table>
<thead>
<tr>
<th>Type of smoker</th>
<th>AAT Direct</th>
<th>AAT Indirect</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy smokers</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Moderate smokers</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Light smokers</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Sum</td>
<td>12</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

**Approach-avoidance task (AAT) development**

In study 2, all of the content of the AAT was developed by authors for Indonesian background and was then tested, analyzed and get approval valid by the researchers. The procedure of AAT in this study was using a 15-inch laptop computer and Joystick. The laptop (ACER Aspire with 4GB Memory and intel core i3) was used to show pictures for the AAT. The pictures contained stimuli with two types of content, that is smoking-related pictures and Neutral-related pictures. Instruction for AAT is to control a flight simulator joystick from Logitech with model of Logitech Extreme 3D Pro Joystick Flight Simulator (see Figure 3 below) with two alternative actions, push or pull every time participant saw a picture appeared in laptop screen. In Figure 3, we can see photo illustration of individuals working on an AAT. The individual in the image is a research assistant and has given consent for his photo to be published.

The AAT program is developed for measurement and a form of intervention. The AAT is used as a measurement of the accuracy and time duration of the participant in responding according to the task. The task of the subject is to respond to the stimuli that appear, as quickly as possible by pushing or pulling the joystick. The joystick is connected to the computer and arises from a zooming effect where the subject pulls the joystick and the effect decreases when the subject pushes the joystick. The image will be lost when the joystick is 30° closer to or away from the subject. The joystick is returned to the neutral position when the image disappears as a signal for the next image to appear (See Figure 4). The screen background is white and the instructions are black.

![Figure 3. Approach-avoidance task (AAT) illustration (Consent was obtained from the researcher included in this image for publication of this figure).](image-url)
Before being given the smoking AAT, each participant was given an exercise consisting of two different colored blank pictures for the practice session. Participants were instructed to pull the Joystick when a blue image appears and push the Joystick to a red image. The instructions given to the participants to complete the task was to push the joystick when smoking related picture appeared and to pull the joystick when a neutral (non-smoking related) picture appeared. The overall score was obtained by comparing differences between pull-push reaction time in smoking-related stimuli and neutral-related stimuli.

The main purpose of the retraining AAT is to create avoidance action tendencies toward smoking-related objects by manipulating the task. For intervention purpose, AAT is used as retraining task which can predict the effect of shaping avoidance behavior toward cigarette stimuli. The implementation of AAT intervention was given in two forms, direct and indirect AAT retraining.\(^{27}\) In the retraining AAT, pictures can be showed in two position; landscape or portrait. The procedure for giving AAT in one administration is 100 trials, consisting of 20 exercise trials and 80 trials of AAT. The practice trial consisted of 10 appearance of a blue image and 10 appearances of a red image. The method of retraining AAT is by experiment with pretest-posttest control group design (See Table 2).

The ATT direct trial consisted of 20 cigarette-related images and 20 neutral images that appeared twice in landscape format only. The data obtained from each trial is from pushing or pulling reaction times.\(^{21,22,27,35}\) The indirect AAT trial consisted of 20 smoking related images showed in landscape format and 20 neutral images in portrait format. When pictures appeared in laptop screen, participants were instructed to push the joystick when landscape picture appeared (contain smoking-related), this means push task given to implicitly train the participants avoid smoking-related pictures. The opposite way, participants instructed to pull the joystick when portrait form appeared (neutral related picture), this means pull task given to implicitly train the participants to approach the neutral related pictures.\(^{21,22,27,35}\) The differences of direct and indirect AAT can be seen in Table 3 below.

### Approach-avoidance task (AAT) measurement

All data in the AAT was collected by the laptop automatically. The setting of the research is a laboratory setting with same controlled environment used for Study 1. The AAT program used was Inquisit Lab 4.0.2.0 software (Millisecond Software, US, RRID:SCR_022151). The latency score obtained from the AAT is said to be the AAT effect. The score is obtained from the difference between each type of image's pushing or pulling reaction times in each combination. In the training and intervention sections, a ‘False’ mark is given as a form of task reminder and feedback. Each image is presented in a pseudorandomized order (pre-determined random order) where combination of pictures showed has been pre-determined and given in a non-sequential manner so that it seems that it has undergone randomization.

### Table 2. Approach-avoidance task (AAT) experiment process.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct AAT</td>
<td>12x measured by AAT</td>
<td>12 x session direct AAT</td>
<td>12x measured by AAT</td>
</tr>
<tr>
<td>Indirect AAT</td>
<td>12x measured by AAT</td>
<td>12 x session indirect AAT</td>
<td>12x measured by AAT</td>
</tr>
<tr>
<td>Control</td>
<td>12x measured by AAT</td>
<td>No-retraining AAT</td>
<td>12x measured by AAT</td>
</tr>
<tr>
<td></td>
<td>Direct AAT</td>
<td>Indirect AAT</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>PUSH</td>
<td>smoking-related picture</td>
<td>PULL neutral picture in LANDSCAPE</td>
<td></td>
</tr>
<tr>
<td>PULL</td>
<td>neutral picture</td>
<td>PUSH smoking-related picture in PORTRAIT</td>
<td></td>
</tr>
<tr>
<td>PUSH</td>
<td>smoking-related picture in LANDSCAPE</td>
<td>PULL neutral picture</td>
<td></td>
</tr>
<tr>
<td>PULL</td>
<td>neutral picture</td>
<td>PUSH neutral picture</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The effects of retraining the AAT was analyzed by t-paired sample to compare which retraining form more effective, and experiment-control posttest data result was analyzed using the t-independent test to investigate if AAT retraining could shape smoking-avoidance behavior tendencies. All ATT data results were analyzed using Official SPSS 23.0 (IBM corporation, 2015, RRID:SCR_016479).

Results
The following is a presentation of the results of the two studies carried out, followed by a discussion of the analysis of the results and limitations of this research.

Study 1
The first study was conducted on 117 participants using a Stroop task to measure attentional bias by comparing reaction time data between smokers and nonsmokers. The result shown in Table 4 suggest that smokers have a longer reaction time than nonsmoker participants. The mean reaction time of smoker participants was 868.62 ms with a standard deviation (SD) of 173.43 ms, and the mean reaction time of nonsmoker participants was 715.45 ms with SD of 131.28 ms.

Further results were analyzed between smoker and nonsmoker data in smoking-related stimuli using ANOVA (See Table 5). This analysis tests a null hypothesis (H0) which states that there is no difference in data between smokers and nonsmokers. To test the hypothesis, it is necessary to look at the probability test value of the F test in ANOVA. If the F probability value (Sig) is smaller than the F table value, which is 3.85 at a 95% confidence level (α value =0.05), then H0 is rejected and H1 is accepted. From result in Table 5 below it can be concluded that the difference in smoking related stimuli show significant F (3,85)=20.665, p value stimuli 0.000<0.05. F-value showed variation between sample means (in this case stimuli and neutral) within the smokers and nonsmokers. It shows a significant difference between smokers and nonsmoker participants in reaction time to smoking-related stimuli. In contrast, analysis also showed that no significant differences in neutral related stimuli (F (3,85)=0.567, p value neutral 0.453>0.05). The test result can be seen in Table 5 below.

This result can be the foundation for selecting a smoker with attention bias. From 65 smoker participants that pass the criteria for having attention bias, there were 52 participant that had a longer reaction time in smoking-related stimuli than neutral related stimuli. The result also shows that the majority of smokers (80%) in the study have attention bias. Unconscious factors shape this generalized smoking behavior. Thereby the intervention of smoking behavior should adopt from the implicit approach.

Study 2
The second study was conducted on 40 of the smoker participants who showed an attentional bias in the first study and were willing to take part in the experiment. Data from a daily survey of participants that monitors the number of cigarettes consumed each day are not explicitly describe in the results because the numbers did not show a significant change. Except in the light smoker group in direct AAT after the fourth week with resulting reducing about 10% of cigarette consumption.

<table>
<thead>
<tr>
<th>Data</th>
<th>Stimuli (ms)</th>
<th>Neutral (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean smokers</td>
<td>868.62</td>
<td>759.13</td>
</tr>
<tr>
<td>SD smokers</td>
<td>173.43</td>
<td>234.54</td>
</tr>
<tr>
<td>Mean nonsmokers</td>
<td>715.45</td>
<td>791.48</td>
</tr>
<tr>
<td>SD nonsmokers</td>
<td>131.28</td>
<td>145.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data</th>
<th>Stimuli (ms)</th>
<th>Neutral (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANOVA (F)</td>
<td>20.665</td>
<td>0.567</td>
</tr>
<tr>
<td>Probability value (Sig).</td>
<td>0.000</td>
<td>0.453</td>
</tr>
<tr>
<td>α value</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Summary</td>
<td>H0 rejected</td>
<td>H0 accepted</td>
</tr>
</tbody>
</table>
The AAT score obtained is the subject’s tendency data where a positive score indicates a tendency to approach the object being measured, while a negative score indicates a tendency to avoid (avoidance) the object being measured. The results used to analyze the effect of retraining AAT came from the t-paired sample that compares the data between indirect and direct AAT that can be seen in Table 6 below.

From Table 6 it can be seen that the average pretest of the direct AAT group was 10.4 ms, and the indirect AAT group was 85.66 ms. In posttest data, the average of the direct AAT group was -153.3 ms, and the indirect AAT group was 79.22 ms. The negative data in direct ATT that this group had a tendency to avoid (avoidance) smoking-related stimuli. This contrasts the results of the indirect AAT group which showed positive score that indicates a tendency to approach the smoking picture stimuli. The differences in data in the pre posttest indirect AAT group was -163.7 ms, but in indirect AAT, the number is -6.444 ms. This means a huge difference in data between direct and indirect AAT. The larger negative or minus (-) difference between pre-test and posttest in direct AAT showed that direct ATT more effectiveness of forming greater avoidance behavior tendencies than direct AAT form. This earlier result leads to the conclusion that direct AAT is more effective in shaping avoidance tendencies to smoking-related stimuli. The further result of experiment groups that showed difference of direct and indirect groups can be seen in Table 7.

Further analysis was conducted to know which form of retraining ATT had more effective avoidance tendencies toward smoking-related stimuli by comparing data between direct and indirect AAT that were analyzed by t-paired sample (See Table 7). To test the hypothesis, it is necessary to look at the probability test value of the t test. If the value of t probability value (Sig) is less than the alpha value of 0.05, then H0 is rejected and H1 is accepted. This analysis tests a null hypothesis (H0) which states that there is no difference in data between pre-test and post-test. The result showed, in the direct ATT group, there was significant differences (t(10)=3.412, p<.05). The indirect ATT group gave another result that showed no significant differences between pre-test and posttest data (t(12)=0.098, p>.05). These results show that the direct AAT form was a more effective intervention than the indirect AAT form to shape avoidance tendencies to smoking-related stimuli. The further result showed in Table 8.

<table>
<thead>
<tr>
<th>Group data</th>
<th>Pre-test (ms)</th>
<th>Post-test (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct means</td>
<td>10.4</td>
<td>-153.3</td>
</tr>
<tr>
<td>Indirect means</td>
<td>85.66</td>
<td>79.22</td>
</tr>
<tr>
<td>Direct difference</td>
<td>-163.7</td>
<td></td>
</tr>
<tr>
<td>Indirect difference</td>
<td>-6.444</td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Data of experiment groups.

<table>
<thead>
<tr>
<th>Data</th>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result of t-paired</td>
<td>3.412</td>
<td>0.098</td>
</tr>
<tr>
<td>Probability value (Sig).</td>
<td>0.008</td>
<td>0.924</td>
</tr>
<tr>
<td>α value</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Summary</td>
<td>H0 rejected</td>
<td>H0 accepted</td>
</tr>
</tbody>
</table>

Table 7. Data of experiment groups.

<table>
<thead>
<tr>
<th>Data</th>
<th>Direct vs control group</th>
<th>Indirect vs control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>t value</td>
<td>2.685</td>
<td>0.189</td>
</tr>
<tr>
<td>Probability value (significance)</td>
<td>0.015</td>
<td>0.852</td>
</tr>
<tr>
<td>α value</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Summary</td>
<td>H0 rejected</td>
<td>H0 accepted</td>
</tr>
</tbody>
</table>
The last analysis was conducted to prove that retraining AAT has an effect that could shape smoking-avoidance behavior tendencies by comparing the experimental and control groups. The null hypothesis (H0) proposed is there no difference scores between of the experimental group and the control group. The results are described in Table 8 above. This was analyzed by a t-independent test that compared experiment-control posttest data. The results showed that direct AAT had significantly different results when compared to the control group (t(10)=2.685, p<.05). Showing that direct ATT shows an influence on the formation of avoidance behavior tendencies on smoking picture stimuli. By contrast, the comparison between the indirect AAT and control group show no significant differences (t(12)=0.189, p>.05). These results show that only direct AAT form intervention that has impact to shaping smoking-avoidance behavior tendencies.

Discussion
The main findings of the first study were as follows: The study with Stroop task measurements revealed that smoking behavior was associated with attention bias. The background of the majority of smoking participants who experience attentional bias and included in this study were moderate smokers.

Smoking as addictive behavior is sustained by an implicit condition which was an attention bias toward smoking-related stimuli among smokers. In the first study, using a Stroop task proved that smoking addiction is, at least in part, because of the strong implicit association that smokers have compared to nonsmokers. The result showed that the reaction time of smokers was longer than nonsmokers. This result can be used as the basis to develop an intervention with the implicit approach conducted in the second study. This result also confirms that smoking behavior is caused by conscious behavior and is heavily influenced by implicit associations. Data on Indonesian smokers who are participants in this study showed similarities with various previous implicit studies on addiction, especially smoking cigarettes addiction.

The main findings of the second study were as follows: automatic action tendencies to approach cigarette smoking was changed successfully using new adaptation training that was developed from a direct AAT retraining form which shows a significant difference between before and after intervention (See Table 7) and significantly different than the control group (Table 8). From the measurement results of the pretest and posttest, AAT found a decrease in score from the beginning of the experiment until the end of the experiment that showed indications that retraining could affect the behavior of participants causing them to avoid smoking stimuli. This result can strengthen the data finding that retraining is an effective intervention in shaping behavior, in this case, avoidance behavior.

The comparative data results between the direct AAT and the indirect groups in showed no significant difference between pretest and posttest (Table 7) and no significant difference with control group (See Table 8). These result concluded retraining in the form of indirect AAT is not effective to shape avoidance behavior tendencies to smoking related stimuli. The result of indirect AAT group showed that intervention using inexplicit instruction in the task has no significant effect. This contradiction between direct and indirect forms of AAT needs further research and analysis to understand factors that cause direct intervention to be more effective in Indonesian smokers than indirect. Previous western background studies have succeeded in making interventions for alcohol addiction using an implicit approach that are indirect and subtle. Researchers initially assumed that developing smoking-related intervention could have the same basic assumption. In this case, alcohol is an addictive object that is accepted as part of social consumption in western culture, just as cigarettes are part of a social ritual among males in Indonesian culture. But as the result of Study 2 differ from previous studies, it suggests that the different object stimuli can be one of the reasons for determine effectiveness of form intervention.

Result on the effectiveness of direct AAT also can be considered in providing form of interventions for shaping healthy behavior in Indonesian culture. The straightforward instruction for participant in direct ATT to push (avoidance) the smoking related picture easier to perceive consciously and form stronger behavioral tendencies, in this case avoidance behavior. This could mean that concrete and direct instructions are easier to understand and apply in the Indonesian population. The direct AAT instructions make it easier for participants to know the behavior they want to change or intervene in, in this case avoiding smoking stimuli. This could form the basis for the development of smoking reduction interventions by using directly stated instructions to avoid smoking-related stimuli. Experimentally this form of instruction is more effective showing significant results compared to indirect instructions. In direct AAT, the participants more quickly realized cigarettes or smoking related stimuli that should be avoided. Whereas in indirect AAT, participants did not immediately realize that they were asked to avoid smoking stimuli. Indirect instructions showed insignificant results in Indonesian smokers. This is still an assumption from the results of this study and needs more further analysis.

This pilot study has categorized the level of smoking addiction among smoker participants. However, this data is only done so that there is a balance between the types of smokers in each group. There is some suggestion to include considerations of reducing cigarette smoking consumption based on the level of nicotine addiction.
study 2, regarding changes in cigarette consumption a decrease in cigarette consumption, around 10%, among light smokers in the direct AAT group that emerged in the 4th week. However, this is a very small number of participants and weak as evidence. This result needs further research and analysis.

As a pilot study, this research still has many limitations. The number of participants is still very limited amid the large smoking population in Indonesia. For future research, it is recommended to develop retraining with more participants. Participants who only come from the student population with upper-middle socioeconomic levels should also be expanded to include various types of smokers from various demographics. Social and cultural factors also need to be addressed in smoking behavior research. Indonesia is a country with a large range of social diversity and large sociocultural influences in developing interventions. The condition of cigarettes having free access to an extraordinary rush of advertisements in Indonesia is certainly a cognitive obstacle to quitting smoking.39

The experiments in this study carried out was the laboratory using strict procedures during retraining. However, the conditions between the time of the experiment were a factor that could not be controlled. So, there are still many possibilities that influence participants' smoking behavior.40 Control conditions over longer periods of time need to be carried out if better retraining is needed. AAT intervention in these experimental retraining conditions is given through a laboratory computer (laptop) which, as a media, are only accessed through certain software and are not connected to the internet. As a developed country, Indonesia still has limited resources, especially in online research. In another country, currently, interventions are being developed online and even implemented on smartphone devices.17,18 This pilot study is conducted in experimental research in a laboratory setting that would be improved if it was developed in the context of the reality of smokers in everyday life.

Conclusions
From these two studies conducted, the main conclusion is that the Stroop task measurement revealed that smoking behavior was associated with attention bias. The results showed that the reaction time of smokers was longer than nonsmoker participants. This result can be used as evidence of smoking intervention techniques based on an implicit approach, specifically for Indonesian target population. Automatic action tendencies to approach cigarette smoking were changed successfully using a new adaptation training developed from the retraining Approach Avoidance Task (AAT). The form of AAT that proved to effect and more effective in shaping smoking-avoidance behavior tendencies is direct AAT. The development of interventions in efforts to stop smoking must continue to be carried out, with the results of this study being an alternative intervention through an implicit approach.

Data availability
Underlying data
OSF: Smoking behavior intervention based on implicit approach: a pilot study in Indonesia, https://doi.org/10.17605/OSF.IO/3PFSR.53

This project contains the following underlying data:

- Smoking Stroop Task in Indonesian
  - Rekap Smoking ST.xlsx (Raw data of Smoking Stroop Task from Study 1 in excel file)
  - Indonesian Smoking Stroop Task Script.txt (Script file from Stroop Task in Indonesian in simple text form)
  - Smoking Stroop Task Fix.iqx (Script file from Stroop Task in Indonesian in inquisit form)
  - Tata Laksana Stroop Task.docx (Smoking Stroop Task protocol in Indonesian language)

- Approach Avoidance Task (AAT) Smoking in Indonesia
  - Form Isian AAT.docx (Daily form for smoking survey during AAT retraining in Study 2)
  - Raw Data Reaction Time AAT.xlsx (Raw data of experiment and control groups in Study 2)
  - Tata Laksana AAT.docx (Smoking AAT protocol in Indonesian language)
AAT Pictures Folder (a folder containing 20 images used in smoking AAT consists of 10 images in portrait -P initials and 10 landscape- L initials images in jpg form)

ALAT UKUR AAT.iqx (AAT measurement script for pretest and posttest in inquisit form)

ALAT UKUR AAT SCRIPT.txt (AAT measurement script for pretest and posttest in simple text form)

DIRECT AAT.iqx (AAT Direct retraining script in inquisit form)

DIRECT AAT SCRIPT.txt (AAT Direct retraining script in simple text form)

INDIRECT AAT.iqx (AAT Indirect retraining script in inquisit form)

INDIRECT AAT SCRIPT.txt (AAT Indirect retraining script in simple text form)

**Extended data**

OSF: Smoking behavior intervention based on implicit approach: a pilot study in Indonesia, [https://doi.org/10.17605/OSF.IO/3PFSR.53](https://doi.org/10.17605/OSF.IO/3PFSR.53)

This project contains the following extended data:

- Smoking Survey in Indonesian
  - Buku Soal.docx (File document from the question book related to smoking survey in Indonesian)
  - Lembar Jawaban.docx (the answer sheet for filling out the question book related to smoking survey in Indonesian)
  - Smoking Survey Data (Raw data of Smoking Survey in excel file)
  - Surat Kesediaan.docx (Inform Consent form of Participants)

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

**Software availability**

All software instruments used in this research can be accessed in millisecond.com website. SPSS software can be purchased in IBM website. DMDX is an alternative software for measurement reaction time and visualization of experimental scripts (both stroop task and AAT) which can be obtained free of charge on the website [http://www.u.arizona.edu/~kforster/dmdx/download.htm](http://www.u.arizona.edu/~kforster/dmdx/download.htm)

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**References**


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