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KAP (Knowledge, Attitude and Practices) Analysis during Two Consecutive Waves of COVID-19 in India

By Ritu Mittal Gupta, Sukhdeep Kaur Mann & Anjali Negi

Abstract- COVID-19 was declared a pandemic by the World Health Organization (WHO) in January 2020. Considering its unprecedented mortality and morbidity, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries including India applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. In this regard a KAP analysis was conducted to understand the public knowledge, reactions, adherence to, and acceptance of measures for protection against COVID-19 during first and second wave of Covid 19. Individuals above the age of 15 years were selected as the sample. The data were collected during both waves of the COVID-19 pan India from 500 respondents using a self-administered questionnaire in Google form. The results revealed that the majority of the respondents were knowledgeable regarding the spread, prevention and control of the COVID virus. Most of the respondents had positive attitude regarding control measures imposed by the government which was consistent with their attitude and practices during first wave. However, a negative change in the attitude of the respondents and practices despite rise in knowledge indicates the role of compelling variables like economic crisis, emotional crisis and individual’s reduced functioning.

Keywords: COVID-19, lockdown, knowledge, attitude, practices.

KAP (Knowledge, Attitude and Practices) Analysis during Two Consecutive Waves of COVID-19 in India

Ritu Mittal Gupta *, Sukhdeep Kaur Mann ° & Anjali Negi ♡

Abstract: COVID-19 was declared a pandemic by the World Health Organization (WHO) in January 2020. Considering its unprecedented mortality and morbidity, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries including India applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. In this regard a KAP analysis was conducted to understand the public knowledge, reactions, adherence to, and acceptance of measures for protection against COVID-19 during first and second wave of Covid 19. Individuals above the age of 15 years were selected as the sample. The data were collected during both waves of the COVID-19 pan India from 500 respondents using a self-administered questionnaire in Google form. The results revealed that the majority of the respondents were knowledgeable regarding the spread, prevention and control of the COVID virus. Most of the respondents had positive attitude regarding control measures imposed by the government which was consistent with their attitude and practices during first wave. However, a negative change in the attitude of the respondents and practices despite rise in knowledge indicates the role of compelling variables like economic crisis, emotional crisis and individual’s reduced functioning.

Keywords: COVID-19, lockdown, knowledge, attitude, practices.

1. Introduction

On 31, December 2019, The World Health Organization (WHO) reported the occurrence of an unknown virus causing respiratory problems. The virus was later named by the International Committee as Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2) that causes COVID-19 or the Corona virus disease (Li et.al., 2020). Considering unprecedented mortality and morbidity due to COVID-19 and its impact on humankind, WHO declared it as a serious public health emergency of international concern on January 30, 2020 (Zhu et. al., 2020). Since then, COVID-19 has taken a heavy toll on the world, claiming many lives. The virus spreads between humans by coughing discharge that contaminates the surfaces. It can also be highly transmitted by asymptomatic individuals during the virus incubation period. The virus can last on surfaces up to 5 days depending on the type of surfaces, although infected people may be asymptomatic, others may develop flu-like symptoms including fever and coughing, which may deteriorate in some cases (Rothan and Reddy 2020).

To prevent the infection socially, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. Also, effective preventive measures were recommended to the public including hand washing, social distancing, mask-wearing, respiratory hygiene (covering mouth and nose while coughing or sneezing), household ventilation and disinfection, and reduction of interpersonal contacts by avoiding visiting crowded spaces (WHO,2020).

India, being one of the largest democratic countries in the world and home to 1.38 billion people, had its first case as early as 30th January 2020 in the Kerala state (Andrews et. al. 2020). Subsequently, the number of cases drastically rose. On 22 March, 2020 the Indian Government imposed a nationwide lockdown to curb the rising cases of Corona virus. An estimated of 32 lakh people died of Covid-19 from June 1, 2020 to July 2021 in India (The Tribune, 2022). Daily cases peaked mid September 2020 with over 90,000 cases per day dropping to below 15,000 in January 2021. Second wave began in March 2021, was much more devastating than the first with shortage of beds, hospitals, vaccines, oxygen cylinders etc. in different parts of the country. On 30th April 2021, India became the first country to report over 400,000 new cases in 24 hours period.

Amidst pandemics, educating, engaging, and mobilizing the public to become active participants help achieve public health emergency preparedness, reducing the overall population’s vulnerability (Lee and You, 2020). Distributing proper information can not only guide society through such events but can also increase epidemic preparedness that might occur in the future. On the other side, negative attitudes and practices towards new infectious diseases can aggravate epidemics which may eventually result in pandemics (Alahdal,2020). When people collectively engage in preventive behaviors, including practicing personal...
hygiene and maintaining social distance, it is possible to control the spread of the disease. Individual behaviors may dramatically decrease morbidity and mortality rates of COVID-19 (Anderson et al. 2020). The knowledge, awareness, and practice (KAP) studies, helps to understand the public knowledge, reactions, adherence to, and acceptance of measures that affect psychologically, socially, and physically the daily life of people (Rugarabamu et al., 2020). The information improves the awareness level of the citizens as well as encourage positive attitudes, which could help in the fight against COVID-19 and similar future threats (Gupta et al., 2020). Keeping in view the above scenario the present study was conducted to assess the difference in the knowledge and attitude of the people regarding Covid-19 as well the practice adopted by the Indians to fight against the disease during first two waves.

II. Methods and Materials

The study was based on data collected from 500 respondents selected from different zones of India namely North, South, Central, East and West during the years 2020 and 2021. For the study, a web based survey was conducted to evaluate public’s knowledge, attitudes, and practices during the COVID-19 epidemic, using a self-administered questionnaire in Google form. Individuals above the age of 15 years were selected as the sample. The questionnaire consisted of four parts. The first part covered the demographic profile of the respondents. The second part was about the knowledge of the respondents about COVID-19. Attitude of the respondents towards COVID-19 was seen in the third part and lastly COVID appropriate practices adopted by the respondents were noted in the fourth part.

Respondents’ knowledge about COVID-19 was assessed using a self-structured questionnaire consisting thirteen questions regarding the symptoms, prevention and control of the disease comprising of 6 negative and 7 positive statements. The responses were recorded under three categories as “true”, “false” and “I don’t know” with score of 3, 2 and 1 respectively for positive statements. The scoring was reversed for the negative statements. The attitude of the respondents was measured using a three point rating scale consisting of 6 statements, the response of which were recorded as “Agree”, “Neutral” and “Disagree” with score of 3, 2 and 1 respectively for positive statements. The scoring was reversed for the negative statements.

To curb the spread of the virus Government suggested several practices for the people to follow. In this regard 10 statements were developed to test the adherence of the population to those practices. The responses were recorded as ‘Always’, ‘Often’, ‘Sometimes’ and ‘Never’ with the score of 4, 3, 2, and 1 respectively.

Social media platforms such as Facebook, What’s App etc., were used to disseminate the questionnaire which was accessible by clicking on the link. The respondents were requested to click on the link and fill in the information. During the first wave, 569 respondents filled the questionnaire. These respondents were again requested to fill the same questionnaire via emails during second wave. Overall 500 questionnaires received back thus the present analysis is based upon 500 respondents.

III. Result and Discussion

The results of the study are discussed under four headings namely demographic profile of the respondents, Knowledge of the respondents regarding Covid-19, Attitude of the respondents towards Covid-19 and practices followed by the respondents during Covid-19 pandemic.

Table 1: Demographic profile of the respondents

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<th>Profile</th>
<th>Frequency</th>
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<tr>
<td>Zone</td>
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<tr>
<td>North</td>
<td>242</td>
<td>48.4</td>
</tr>
<tr>
<td>South</td>
<td>31</td>
<td>6.2</td>
</tr>
<tr>
<td>Central</td>
<td>99</td>
<td>19.8</td>
</tr>
<tr>
<td>East</td>
<td>65</td>
<td>13</td>
</tr>
<tr>
<td>West</td>
<td>63</td>
<td>12.6</td>
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<tr>
<td>Area of Residence</td>
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<tr>
<td>Rural</td>
<td>301</td>
<td>60.2</td>
</tr>
<tr>
<td>Urban</td>
<td>199</td>
<td>39.8</td>
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<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>262</td>
<td>52.4</td>
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<tr>
<td>Female</td>
<td>238</td>
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<tr>
<td>Age</td>
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<tr>
<td>15-30yearsold</td>
<td>306</td>
<td>61.2</td>
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<td>31-45yearsold</td>
<td>160</td>
<td>32</td>
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<td>46-60yearsold</td>
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<td>above60yearsold</td>
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<td>Secondary level (10th)</td>
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<td>Home-maker</td>
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<td>Farmer</td>
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</table>

Table 1 represents the demographic profile of the respondents. The results reveal that nearly half of the respondents (48.4%) were from Northern zone of India followed by Central zone with 19.8% respondents. Approximately equal number of respondent’s i.e. 13% and 12.6% were from East and West zone respectively.
while only 6.2% of the respondents belonged to South zone. The male population was 52.40% and while women contributed 47.60% of the population. Majority of the respondents (61.2%) were between 15 to 30 years of age followed by 32% in the age group of 31 to 45 years. The data further revealed that majority of the respondents (56.2%) were graduate, followed by 20.4% postgraduate while few (2.0%) respondents had education below secondary level. Majority of the respondents (41.1%) were engaged in service sector while 39% of the respondents were students.

IV. Knowledge of the Respondents Regarding Covid-19

A glance at table 2 depicts the knowledge of the respondents regarding COVID-19 during first and second wave. The data reveals that majority of the respondents were knowledgeable regarding the spread and prevention of the COVID-19 virus. This finding is consistent with the cross-sectional study done across the Saudi population by Al-Hanawi et al., (2020), where the participants achieved a mean of 81.64% in the knowledge questionnaire.

The data further depicts the positive percentage change in the knowledge of the respondents from 79.28% in 2020 to 93.69% in 2021 which accounts for 14.41% increase in the knowledge. The similar change in knowledge was seen in the study conducted in 2020 by Nazar et. al., in which, at the beginning of the pandemic many people were not much familiar with disease. News websites and social media were the main sources of knowledge. However in the second wave the respondents indicated using other sources of knowledge such as governmental and science-oriented websites with up to date information and findings presented in scientific knowledge sources.

<table>
<thead>
<tr>
<th>Knowledge Statements</th>
<th>First wave f(%)</th>
<th>Second wave f(%)</th>
<th>Percent Change</th>
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<tbody>
<tr>
<td>The COVID-19 virus spreads via respiratory droplets of infected individuals.</td>
<td>449(89.8)</td>
<td>500(100)</td>
<td>+10.2</td>
</tr>
<tr>
<td>Wearing a mask will reduce the risk of COVID-19 infection.</td>
<td>325(64.9)</td>
<td>470(94)</td>
<td>+29.1</td>
</tr>
<tr>
<td>The main clinical symptoms of COVID-19 are fever, dry cough and Myalgia.</td>
<td>456(91)</td>
<td>500(100)</td>
<td>+9.0</td>
</tr>
<tr>
<td>There is currently no effective cure for COVID-19.</td>
<td>417(83.2)</td>
<td>450(90)</td>
<td>+6.8</td>
</tr>
<tr>
<td>Early symptomatic and supportive treatment helps the patients to recover from the infection.</td>
<td>364(72.7)</td>
<td>415(83)</td>
<td>+10.3</td>
</tr>
<tr>
<td>People of all age groups are susceptible to infection by COVID-19.</td>
<td>448(89.4)</td>
<td>480(96)</td>
<td>+6.6</td>
</tr>
<tr>
<td>Hand hygiene is the most important way to prevent the spread of the virus.</td>
<td>474(94.6)</td>
<td>490(98)</td>
<td>+3.4</td>
</tr>
<tr>
<td>Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus.</td>
<td>476(95)</td>
<td>500(100)</td>
<td>+5.0</td>
</tr>
<tr>
<td>Eating Vegetarian or Non-vegetarian food has nothing to do with COVID-19 infection.</td>
<td>358(71.7)</td>
<td>425(85)</td>
<td>+13.3</td>
</tr>
<tr>
<td>COVID-19 virus remains on different surfaces for more than 10 hours to 3 days.</td>
<td>370(73.9)</td>
<td>450(90)</td>
<td>+16.1</td>
</tr>
<tr>
<td>This disease can spread from currency notes, newspapers etc.</td>
<td>389(77.6)</td>
<td>460(92)</td>
<td>+14.4</td>
</tr>
<tr>
<td>A person can be infected by COVID-19 for the second time also.</td>
<td>370(73.9)</td>
<td>490(98)</td>
<td>+24.1</td>
</tr>
<tr>
<td>COVID-19 will not end even if the weather is warm.</td>
<td>265(52.9)</td>
<td>460(92)</td>
<td>+39.1</td>
</tr>
<tr>
<td>Overall knowledge percent</td>
<td>79.28</td>
<td>93.69</td>
<td>+14.41</td>
</tr>
</tbody>
</table>

Majority of the respondents in both the years had knowledge regarding the mode of transmission of the disease as 89.8% respondents in 2020 and cent percent in 2021 agreed that the “COVID-19 virus spreads via respiratory droplets of infected individuals” nearly 65% of the respondents in 2020 and 94% in 2021 said that “wearing a mask will reduce the risk of COVID 19 infection”. This result is congruent with the results of the study conducted by Tran (2020) where the majority of participants displayed knowledge about the “clinical and pathogen characteristics of COVID-19”.

As far as clinical symptoms were concerned majority that is cent percent of the respondents in 2021 and 91% in 2020 were knowledgeable about the symptoms of corona virus. Hand hygiene (98% in 2021 and 94.6% in 2020) and Isolation and treatment of people infected with the COVID-19 virus (100% in 2021 and 95% in 2020) were reported as the effective ways to reduce the spread of the virus. Similar results were revealed in the study conducted by Aalahdal et. al., (2020) where majority of the respondents were aware that virus could be transmitted from an infected person (99%), through touching contaminated surfaces and shaking hands (98%), using COVID-19-infected personal tools (94.9%) and through coughing (92%). Further in2021, 98% of the respondents agreed that the
person could be re-infected by COVID-19 virus even if he/she has successfully recovered from the first infection.

It was interesting to note that 47.10% of the respondents in 2020 believed that the warm weather will end the COVID-19 virus, however in 2021 (92%) of the people were aware of the fact that corona virus was unaffected by the weather changes. Majority of the respondents (90%) till 2021 said that there was no cure for the corona virus. The study conducted by Weitz et. al., (2020) also revealed the similar results where majority of respondents agreed that there are neither available vaccines (56%), nor the use of antibiotics is sufficient to kill the virus (60%). Further 96% of the respondents in 2021 knew that people of all age groups were susceptible to COVID-19 infection.

V. ATTITUDE OF THE RESPONDENTS TOWARDS COVID-19

The data in Table 3 represents the mean values regarding attitude of the respondents towards COVID-19

<table>
<thead>
<tr>
<th>Statements</th>
<th>First wave (Mean score)</th>
<th>Second wave (Mean score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To fight against this pandemic disease, taking precautions are better than.</td>
<td>2.95</td>
<td>2.86</td>
</tr>
<tr>
<td>I will not isolate or quarantine myself if I had fever and cough.</td>
<td>2.55</td>
<td>1.67</td>
</tr>
<tr>
<td>India’s decision of lock-down was correct.</td>
<td>2.95</td>
<td>2.25</td>
</tr>
<tr>
<td>There is no need to keep a distance of one meter or more from others when coughing or sneezing.</td>
<td>2.77</td>
<td>2.80</td>
</tr>
<tr>
<td>COVID-19 will finally be successfully controlled.</td>
<td>2.60</td>
<td>2.56</td>
</tr>
<tr>
<td>Donating money to the NGOs who are working against COVID-19 is more beneficial than donating it to the PM/CM care fund.</td>
<td>1.77</td>
<td>2.12</td>
</tr>
<tr>
<td>Overall mean</td>
<td>2.60</td>
<td>2.38</td>
</tr>
</tbody>
</table>

Majority of the respondents agreed on taking precautions against the pandemic with mean scores of 2.95 and 2.86 during first and second wave respectively. A lady, who lost her husband as well as her younger son during pandemic, regretted their families’ careless attitude toward preventive measures. Another 23 year old boy, who lost his mother during first wave, said that they initially thought COVID-19 was just a superstition but it ruined his life as his father also could not survive after that. During first wave, the respondents had positive attitude towards isolating themselves if they showed any symptoms of the disease. The results were in line with findings of the study conducted in 2020 in which over 90% of the respondents had favorable attitude in limiting the spread of COVID-19 as “staying at home” and “isolating the infected individuals” ranked first with 99.7% and 99.9% respectively. These measures have been taken by many countries and have shown to be significantly successful in controlling the spread of the virus (Anderson et. al., 2020).

However during second wave attitude towards isolation was not that positive. This could be due to various socio-economic consequences of pandemic. The global impact of the COVID-19 pandemic increased the loans required by people, which was a financial catastrophe for many workers and employees who lost their jobs (Nicola et al., 2020). UNESCO estimated that approximately 900 million learners have been affected due to the disruption in education due to COVID-19 (Viner et al., 2020). People had difficulty in accessing healthcare services, which may increase the risk of chronic disease deterioration (Liu et al., 2020). Many people (17.9%) reported a physical and/or verbal abuse episode from family members, (11.9%) reported abuse outside the family, and (7.9%) reported abuse from enforcers, during the lockdown (Msherghi et. al., 2020).

During first wave participants were also in favor of Government’s decision of lockdown during pandemic as indicated by the mean score of 2.95 in first wave. This finding is consistent with the studies conducted in China and Saudi where majority of the participants were
convinced that their Government will combat the disease (Hanawi et. al., 2020, and Zhong et. al., 2020). The agreement to lockdown however reduced drastically during second wave. This is obvious as many people suffered financial crunch due to lock down. As far as social distancing was concerned majority of the respondents said that it was best to keep a distance of one meter or more from others while coughing or sneezing. Majority of the respondents had positive attitude that COVID-19 will be successfully controlled with nearly similar mean score (2.60 and 2.56) for both the years. People had neutral attitude towards donating money to the NGO’s working against COVID-19 than donating it to the PM/ CM care fund during both waves.

Table 4: Comparison of the practices followed by the respondents to safeguard themselves from the COVID-19 infection

<table>
<thead>
<tr>
<th>Statements</th>
<th>First wave Mean value (1-4)</th>
<th>Second wave Mean value (1-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid going out during lock-down</td>
<td>2.71</td>
<td>2.43</td>
</tr>
<tr>
<td>Wash/sanitize hands after coming back home.</td>
<td>2.94</td>
<td>2.51</td>
</tr>
<tr>
<td>Wash hands at least for 20 sec with soaps</td>
<td>2.74</td>
<td>2.32</td>
</tr>
<tr>
<td>Wear face mask when leaving home</td>
<td>2.80</td>
<td>2.17</td>
</tr>
<tr>
<td>Changed the routine food pattern during lock-down to increase immunity.</td>
<td>2.19</td>
<td>1.85</td>
</tr>
<tr>
<td>Sanitize your mobile phones, TV remotes and kids play toys.</td>
<td>2.06</td>
<td>1.72</td>
</tr>
<tr>
<td>Increased the consumption of vitamin C rich foods during this lock-down.</td>
<td>2.16</td>
<td>2.40</td>
</tr>
<tr>
<td>Take extra care and other precautionary measures while going for grocery shopping.</td>
<td>2.71</td>
<td>2.31</td>
</tr>
<tr>
<td>Keep groceries aside for 2-3 days after bringing home.</td>
<td>2.04</td>
<td>1.36</td>
</tr>
<tr>
<td>Discard the container/poly bags of groceries in a closed dustbin.</td>
<td>2.56</td>
<td>1.25</td>
</tr>
<tr>
<td>Overall mean</td>
<td>2.50</td>
<td>2.03</td>
</tr>
</tbody>
</table>

From the results it is revealed that a greater number of people avoided going out during lockdown during first wave than during second wave as the mean scores went down from 2.71 to 2.43. This could be due to the reduced fear in public as it was impairing their businesses and work. Kelvin (1997) put forward that the amount and severity of anxiety that is faced is important in determining whether it will impair the individual’s functioning. Majority claimed to sanitize/wash their hands after coming back to home however its frequency also went down from always to sometimes as indicated by the change in the mean score from 2.94 to 2.51. The frequency of using face mask when going outside also went down from 2.80 to 2.17. The consumption of vitamin C rich foods by the respondents was increased during lock down as indicated by the mean scores of 2.16 and 2.40 while nearly half of the respondents in both the waves reported to have changed their routine food pattern during lock- down to increase their immunity.

Majority of the respondents (2.71 and 2.31) took extra care and precautions while going for grocery shopping while they were not very precautious during second wave. In the year 2020, nearly half of the respondents would keep their groceries aside for 2-3 days after bringing home however this number declined in 2021 as the mean scores went from 2.04 to 1.36. As far as sanitizing mobile phones, TV remotes and kids play toys were concerned half of the respondents said that they always sanitized them. Majority of the respondents (2.56) practiced discarding the container/poly bags of groceries in a closed dustbin.

The study revealed that respondents had knowledge regarding prevention and control of the disease which became apparent in their attitude and COVID- appropriate practices during second wave. This observation was in congruence with the results of the study conducted by Erfani et. al., (2020) in which higher knowledge score regarding COVID-19 was significantly associated with a higher likelihood of having positive

VI. Practices Followed by the Respondents During Covid-19 Pandemic

The data in Table 4 represented the comparative analysis of the practices followed by the respondents during the pandemic in the years 2020 and 2021. A glance of the table shows that people followed the practices for the prevention and control of the virus more during first wave as compared to second wave.
KAP (Knowledge, Attitude and Practices) Analysis during Two Consecutive Waves of COVID-19 in India

VII. Conclusion

As far as practices were concerned majority of the respondents followed the practices strictly in the year 2020 however they seemed reluctant to do so in the year 2021. This was due to their psychological needs, reduction of individual’s output due to fear and anxiety. Given the present situation of the pandemic, new strains of the virus are identified every year thus making it highly unpredictable whether the virus could be contained or not there of republic adherence to preventive and control measures and a routine practice of precautionary behaviors must become the new status quo.

References Références Referencias


A Numerical Criterion for Assessing the Discriminative or Aggregative Potential of a Taxonomic Character. Part II

By Joaquim Carlos Sena Maia

Universidade Federal do Paraná

Summary: An alternative method to assess the aggregative/discriminative potential of taxonomic characters for continuous variables obtained through measurements.

Keywords: numerical method; taxonomy; potential, aggregative, discriminative; character.

GJSFR-I Classification: DDC Code: 571.876 LCC Code: QL639.25

Strictly as per the compliance and regulations of:
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Joaquim Carlos Sena Maia

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I. INTRODUCTION

The evaluation of the aggregative or discriminative potential of a biological characteristic (anatomical, morphological, behavioral, etc.) allows estimating the contribution of this characteristic in the formation and systematic delimitation of the taxonomic units where it is used. Maia (2021) presented a method for making this assessment, estimating the potential on a scale from 0 to 5 and working with discrete variables obtained through attribute counting and morphological variations coding.

Similarly, in the present work, we propose a methodology for continuous variables obtained through measurements.

II. MATERIAL AND METHODS

The material used refers to measurements performed on 6 species (n = 6) of the genus Plebeia that occur in southern Brazil: *P. juliani*, *P. meridionalis*, *P. droryana*, *P. emerina*, *P. remota* and *P. saiqui*, represented in the tables by the letters J, M, E, R, S (Maia, 2017). To exemplify the methodology proposed here, we will use measurements (mm) of the width of the jaws of 5 specimens (m = 5) of each species, as shown in Table 1.

| Table 1: Width of the jaw of six species of the genus Plebeia |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|     J           |   R             |    S            |    D            |    E            |    M            |
| 0.90           | 1.40            | 1.20            | 1.15            | 1.50            | 1.00            |
| 1.00           | 1.80            | 1.30            | 1.20            | 1.30            | 0.90            |
| 1.00           | 1.40            | 1.50            | 1.15            | 1.20            | 0.90            |
| 0.90           | 1.45            | 1.30            | 1.20            | 1.20            | 0.70            |
| 0.90           | 1.40            | 1.30            | 1.00            | 1.20            | 0.80            |

Initially, the data are subjected to one-way analysis of variance (ANOVA) and we interpret the test value (F=20.50 - P<0.05) noting that there are significant differences among the analyzed samples, as shown in Table 2.

| Table 2: ANOVA of Width of the jaw of six species of the genus Plebeia |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Source of variation | SS       | DF   | QM  | F     |
| Total            | 1.763    | 29   |      | 20.50 |
| Among groups     | 1.434    | 5    | 0.287 |      |
| Within groups    | 0.324    | 24   | 0.014 |      |

In the next step we will calculate the minimum significant difference (msd) using the standard deviation “within groups”, $S_E = \sqrt{0.014}$ (also called standard error), and a tabular value (q) of the Tukey Test, in order to assess the significance of the differences between the sample means.

**Calculation of msd in this example:**

$$msd = q \cdot \left(\frac{S_E}{\sqrt{m}}\right) = 0.23$$

| Table 3: Means of jaw widths and msd |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| M               | J               | D               | E               | S               | R               |
| 0.86            | 0.94            | 1.14            | 1.28            | 1.32            | 1.49            |

$msd = 0.23$

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The total number of pairs (JM, JD, RS...) is obtained by calculating the combination \( \binom{n}{2} \).

In the case of 6 species, we will have \( 6(6-1)/2 = 15 \) pairs corresponding to the cells in Table 4.

For example, for the pair JM, we calculate the difference between the means \( X_J \) and \( X_M \) and compare it with the msd. If the difference is less than the msd, we accept that the jaw width is statistically equal for both species. The pair is coded as 0 (zero).

The 15 possible comparisons are shown in Table 4 and the zeros in the crossings of the lines and columns corresponding to the letters (M, J, ..., R) show that for those pairs, the jaw width character does not present significant differences. The number of zeros in table 4, that is, the number of pairs whose means do not differ significantly, is represented by the letter Z. In this example:

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>J</th>
<th>D</th>
<th>E</th>
<th>S</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thus, we can calculate the degree of discrimination (D) of the jaw width character through the formula:

\[
D = 5(1 - \frac{2Z}{n(n-1)})
\]

In this example we would have:

\[
D = 5 \left(1 - \frac{2(7)}{6(6-1)}\right) = 2.67
\]

The interpretation of the D value can be done as follows:
- \(0 \leq D \leq 1\) - very aggregative characters
- \(1 < D \leq 2\) - aggregative characters
- \(2 < D \leq 3\) - intermediate characters
- \(3 < D \leq 4\) - discriminative characters
- \(4 < D \leq 5\) - very discriminative characters

III. RESULTS AND DISCUSSIONS

A traditional taxonomic study, which includes both the identification of species and their grouping, forming taxonomic units of a higher hierarchical level (genera, families, etc.), uses the analysis of characters (morphological, anatomical, behavioral, etc.) that guides this ordering.

Most characters contribute to both aggregate and discriminate, in proportions that vary for each character, as demonstrated by Maia (2021).

Taxonomy has been modernized since the creation of Numerical Taxonomy in the 1950s with the pioneering work of Sneath (1957 and 1958) and Michener and Sokal (1957). After that, with the development of new numerical analysis methods such as Principal Component Analysis, Cluster Analysis and others, taxonomists assimilated these new tools.

Ranjana et all (2013) found that traditional taxonomy based on morphology has often failed to accurately identify species due to the occurrence of cryptic species that are reproductively isolated but morphologically identical. They used Discriminant Function Analysis (DFA) and Cluster Analysis and the results show that DFA is a reliable statistical tool for identification and that Cluster Analysis works effectively for classification and species identification.

More recently, the use of DNA to identify and classify species has been widely used and has shown great superiority over traditional methods.

Pfenninger et all (2006) compared the suitability and effectiveness of traditionally used shell morphology with DNA-based methods to distinguish between species of the freshwater snail genus Radix (Basommatophora, Pulmonata).

They concluded that the taxonomic distinction of species of the genus Radix should not be based on the morphology of the shells, as their variability is: i) continuous, ii) largely overlapping between different species and iii) phenotypically plastic in response to environmental conditions. They stated that the greatest conceptual advantage of DNA taxonomy over morphological methods lies in the direct inheritance of the characters used for identification. Unlike many morphological characters, DNA sequences are not subject to potentially misleading environmental or developmental modifications.

From a taxonomic point of view, a given biological character may have an aggregative or a discriminative potential, which can be quantitatively evaluated.

We believe that a preliminary assessment of the possible taxonomic contributions of each character can
help in choosing the variables that will be later used in more sophisticated and costly analyses.

Maia (2021) developed a method to quantify this potential in discrete variables (attribute counts, coding of morphological variations, etc) on a scale between zero and five.

In the present work we deal with the evaluation of this potential in the continuous variables obtained through measurements.

The discrete variable has contours clearly established and can be easily interpreted by counting attributes or by coding qualitative properties (colors, shapes, etc). In continuous variables, the limits of possible groups need to be statistically calculated (Maia, 2017).

The analysis of the differences between the arithmetic means of the studied groups and the construction of confidence intervals allow identifying the formation of possible groups of species whose means do not differ significantly. In this work, we used Tukey's test, calculating the minimum significant difference msd = 0.23 (Sokal & Rohlf, 1981). When interpreting the ANOVA results, it is common to order the means in ascending order and underline those that do not differ significantly. (Gomes, 1970)

<table>
<thead>
<tr>
<th>M</th>
<th>J</th>
<th>D</th>
<th>E</th>
<th>S</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.86</td>
<td>0.94</td>
<td>1.14</td>
<td>1.28</td>
<td>1.32</td>
<td>1.49</td>
</tr>
</tbody>
</table>

These underlined means are statistically equals and coded with zero in Table 4. In this example, of the 15 pairs of possible comparisons, 7 can be considered similar. The discriminative potential of the jaw width characteristic is represented by the 8 comparisons in which the differences between the means are greater than msd.

Direct application of the Tukey test is recommended when the samples have the same size, as in our example, m = 5. If one or more samples do not meet this specification, the Tukey-Kramer test must be used to calculate the msd. It should be remembered that Analysis of Variance should only be used after evaluating the requirements for independence, normality and homogeneity of variances.

In order to allow comparisons between similar analyses, the results can be standardized on a scale between zero and five, whose result D is obtained by calculating the variation of an index that uses the minimum and maximum values within the analyzed group. The aggregative potential (D') is calculated complementary, D' = 1-D, since aggregation and discrimination are complementary concepts. In this example, D = 2.67 suggests that the jaw width character belongs to the intermediate type as it both aggregates and discriminates.

### Table 5: Degree of Discrimination

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt;= D &lt;= 1</td>
<td>Very little discriminative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 &lt; D &lt;= 2</td>
<td>Little discriminative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 &lt; D &lt;= 3</td>
<td>Moderate discriminative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 &lt; D &lt;= 4</td>
<td>Discriminative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 &lt; D &lt;= 5</td>
<td>Very discriminative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 6: Degree of aggregation

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt;= D' &lt;= 1</td>
<td>Very little aggregative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 &lt; D' &lt;= 2</td>
<td>Little aggregative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 &lt; D' &lt;= 3</td>
<td>Moderate aggregative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 &lt; D' &lt;= 4</td>
<td>Aggregative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 &lt; D' &lt;= 5</td>
<td>Very aggregative character</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### IV. CHARACTER WEIGHTING

The values of D and D' can be used as a weighting criterion (for both discrete and continuous variables) when we want to assign different values to some biological characteristics.

The use of weights to rank character contributions in a taxonomic work is quite controversial. There are those who defend it and those who criticize it, since the times when Numerical Taxonomy was established as an alternative method for zoological and botanical classification, such as:

- Sneath (1973) states that the main conceptual difficulty that retarded the progress of the Numerical Taxonomy was the problem of the weighting of characters.
- Michener and Sokal (1957) conclude that, even if it is desirable, there is no rational way to determine character weights and, in practice, we should assign the same weight to all.
- Burtt (1964) warned that numerical taxonomy need not necessarily assign equal weights to all characters (isocratic classification).
- Farris (1966) suggests that characters that vary little within populations are more reliable indicators of cladistic relationships than characters that vary more, and therefore should have greater weights.
- Goodman (1969) believes that a character should be inversely weighted to the variance within the taxonomic unit.
- We do not intend to go into the merits of the disagreements. We just point out that the value D (and D') can eventually be used as a weighting criterion by those who defend this practice.
- Maia (2021) created tables for the values of D and D', but due to a graphical composition error, the tables only showed the amplitudes of variation of the weights and not the respective limits. This flaw is...
now fixed and so we present the two tables as they should have been published.

**V. Conclusions**

- A methodology is presented to assess the discriminative or aggregative potential of continuous variables.
- Analysis of variance (one-way) makes it possible to identify whether there are significant differences among the samples tested and the contribution of the analyzed character to grouping or separating the species.
- The formation of groups whose species are statistically equals for a given characteristic is done through the Tukey Test applied to the means of the measurements of the samples.
- The discriminative/aggregative potential of continuous variables can be expressed on a scale that varies between zero and 5, just as to discrete variables.
- The values of D and D’ can be used as weighting criteria to rank the contributions of characters in taxonomic studies.

**Acknowledgments**

To Dr. Sebastião Laroca for suggestions, to Dr. Gabriel Maia Braga for the text translations and to Dr. Terezinha Iza Cezar for the final review and corrections.

**References Références Referencias**

Background Subtraction of an Indian Classical Dance Videos

By Dr. Suvarna Nandyal & Ms. Bhavana R. M
Visvesvaraya Technological University

Abstract- A slew of motion detection methods have been proposed in recent years. The background includes some constraints such as changes in illumination, shadow, cluttered the background, scene change and speed of dance between hand gestures and body gestures are different. One of the most basic methods for background subtraction is temporal averaging. We looked at a new adaptive thresholding approach in this paper. To identify moving objects in video sequences, an adaptive thresholding is used. Depending upon the speed of the technique we proposed a Gaussian distribution technique. Gaussian distribution done background subtraction depending upon active pixels it differentiates whether it is a background or foreground. The background model's update rate has been modified to be adaptive and determined by pixel difference. Our aim is to improve the method's F-measure by making it more adaptable to various scene scenarios. The experiment results are shown and evaluated. The proposed method and the original method's quality parameters are compared.

Keywords: motion detection, background subtraction, gaussian distribution, the adaptive temporal averaging method.

GJSFR-I Classification: DDC Code: 006.37 LCC Code: TA1634

Strictly as per the compliance and regulations of:
Abstract A slew of motion detection methods have been proposed in recent years. The background includes some constraints such as changes in illumination, shadow, cluttered the background, scene change and speed of dance between hand gestures and body gestures are different. One of the most basic methods for background subtraction is temporal averaging. We looked at a new adaptive thresholding approach in this paper. To identify moving objects in video sequences, an adaptive thresholding is used. Depending on the speed of the technique we proposed a Gaussian distribution technique. Gaussian distribution done background subtraction depending upon active pixels it differentiates whether it is a background or foreground. The background model's update rate has been modified to be adaptive and determined by pixel difference. Our aim is to improve the method's F-measure by making it more adaptable to various scene scenarios. The experiment results are shown and evaluated. The proposed method and the original method's quality parameters are compared.

Keywords: motion detection, background subtraction, gaussian distribution, the adaptive temporal averaging method.

I. Introduction

Analysis and comprehension of video sequences is a growing area of study. The identification of moving objects in the scene is a first step in many applications in this area (video tracking, optical motion capture, multimedia applications). The separation of moving objects, referred to as the foreground, from static data, referred to as the background, is the basic operation required. Background Subtraction is the most commonly used process. Obtaining a background image that does not contain any moving objects is the best way to model the background. The background is not always available in certain environments, but it can always be altered in crucial circumstances such as lighting changes or the addition or removal of items from the scene. As a result, the background representation model must be more adaptable and stable. Every modern video monitoring system includes motion detection.

In computer vision systems, background subtraction is a popular technique for identifying movement regions. It simply refers to the division of the current scene into two parts: the background and foreground. Using a constant model for the background is one of the easiest ways to enforce background subtraction. The moving regions are then distinguished from the background using this model. However, there are several drawbacks to this approach. It is incapable of dealing with changes in lighting, objects being shifted to or removed from the background, shadows, and repeated motion such as the tree leaves, among other things. More intelligent approaches to adapt the background model to the evolving world have been implemented to address at least some of these problems.

Intelligent control systems are capable of distinguishing between moving objects in the foreground and stationary objects in the background, in addition to detecting motion. In recent years, several of these motion detection methods have been proposed. The most widely used techniques for this separation are background subtraction methods [1-3]. Statistical approaches such as Mixture of Gaussians [4-8], Kernel Density Estimation [9], and Eigen backgrounds [10] are more accurate and complex.

The Temporal Averaging Method (TAM) [11-13] is a simple method for background subtraction that is the subject of this article. The original method is shown, and new versions of the algorithm are proposed in this paper. The background model is the first step in the original TAM process. It represents a portion of the scene that is relatively still. Algorithm (3). We find the threshold t adaptive to each pixel difference $d_{(x,y)}$, just as in the first approach.

II. Our Approach

When the scene illumination is constant, the original TAM approach is reasonably effective in estimating foreground-background. However, when there are sudden lighting changes or repeating backgrounds, such as waving trees, there are a lot of false positive pixels and the output parameter levels are lower. The original method's flaw is the slowness with which it updates the background model determined by $\alpha$, (1). For all pixels in the current frame, the method assumes $\alpha$ is equal. When the background is changing rapidly, this is not the best choice. So, if the updating speed could be adjusted to each pixel difference $d_{(x,y)}$, the algorithm would respond faster to sudden light changes and repeated backgrounds. Furthermore, the above-mentioned solution would be insufficient in very
noisy and complex background scenes. An adaptive threshold will be used to reduce the number of false positive pixels in the predicted scene. The threshold $T$ is constant in the original algorithm (3). We find the threshold $t$ adaptive to each pixel difference $d_{t(a,b)}$, just as in the first approach.

### III. Adaptive Thresholding

For every incoming image a new background model $C_{t(x,y)}$ is estimated by:

$$c_{t+1(a,b)} = \alpha I_{t(a,b)} + (1-\alpha)c_{t(a,b)} \quad \text{Eq-1}$$

$I_{t(a,b)}$ is the pixel value, $t$ is the image number, $(a,b)$ is the pixel location in the image and $\alpha$ is learning rate.

The first background is formed by the pixels that have least absolute difference value. Then the absolute difference is calculated by the following equation:

$$d_{t(a,b)} = |I_{t(a,b)} - b_{t(a,b)}| \quad \text{Eq-2}$$

The sum of absolute difference makes pixel by pixel comparison between two consecutive frames. The absolute difference is added up the pixels that have least sum of absolute difference value is the background. To handle variation in background such has color and illumination changes. The rule of updating $\alpha_{t(a,b)}$ is given by:

$$\alpha_{t+1(a,b)} = \beta \left( \frac{c d_{t(a,b)}}{n} \right) + (1-\beta)\alpha_{t(a,b)} \quad \text{Eq-3}$$

$\beta$ is the adaptive learning rate updating $\alpha_{t+1(a,b)}$, $c$ value is given by the user, $n$ is the dynamic range of the signal.

The foreground mask is estimated by the equation:

$$N_{t(a,b)} = \begin{cases} 0, & d_{t(a,b)} < T1_{t(a,b)} \\ 1, & d_{t(a,b)} \geq T1_{t(a,b)} \end{cases} \quad \text{Eq-4}$$

Where $T1_{t(a,b)}$ is adaptive thresholding.

- **a) Modeling background pixels using Gaussian distributions**

To use $K$ Gaussian probability density distributions to constitute the background of each pixel in the image. The pixel $\{a0, b0\}$ is defined as a time series.

$$\{a_1, \ldots, a_t\} = \{K(a_0, b_0) : 1 < j < t\}$$

Where $K$ refers to the image sequence and $a_j$ is the intensity value of the pixel $\{a0, b0\}$ at time instant $j$.

The background pixels are modeled using Gaussian distribution method. The probability of pixel value within the history values of the pixel is determined as

$$f(A_t) = \sum_{j=1}^{K} \omega_j \cdot n(A_t, \mu_{j,t}, \Sigma_{j,t})$$

where $K$ refers to the number of Gaussian distributions used. $\omega_j$ is the weight parameter that is used to describe which part of the data is described by the $i$th Gaussian distribution. $\mu_{j,t}$ is a Gaussian distribution that has two parameters: $\mu_{j,t}$ is the mean of the Gaussian distribution at time $t$ and $\Sigma_{j,t}$ is the covariance matrix at time instant $t$. Any new pixel value is compared to the existing Gaussian distributions for each frame. If a new pixel is within 2.5 standard deviations of the distribution's mean, it is said to fit the distribution. If a pixel matches one of the weighted Gaussian distributions, the distribution's mean and variance are modified.

### IV. Results

![Fig. 1: Input frames of Kuchipudi(a) and Kathak(b)](image1)

![Fig. 2: Segmented frames of Kathak dance](image2)

![Fig. 3: Segmented the frames of Kuchipudi Dance](image3)

Matlab is used to apply the procedures under investigation. The Gaussian distribution approach is contrasted to the Adaptive Temporal Averaging Method.
For two separate videos, kathak and kuchipudi, both methods are used. Each adjustable parameter is expressed as a function of the quality of background subtraction. The F-measure is used to assess the consistency quantitatively. For kathak and kuchipudi, the Gaussian distribution method gives the highest accuracy than the adaptive method, depending on the F-Measure parameter.

**Table 1:** Comparison Accuracy results of the adaptive and Gaussian distribution method

<table>
<thead>
<tr>
<th>Method</th>
<th>Parameter</th>
<th>Test Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive temporal averaging method</td>
<td>Precision</td>
<td>Kathak</td>
</tr>
<tr>
<td></td>
<td>Recall</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>F-Measure</td>
<td>0.68</td>
</tr>
<tr>
<td>Gaussian distribution method</td>
<td>Precision</td>
<td>Kathak</td>
</tr>
<tr>
<td></td>
<td>Recall</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>F-Measure</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Recall</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>F-Measure</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>Recall</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>F-Measure</td>
<td>0.81</td>
</tr>
</tbody>
</table>

**Fig. 4:** Accuracy graph of the evaluation metrics for Adaptive temporal averaging

**Fig. 5:** Accuracy graph of the evaluation metrics for Gaussian distribution method.
V. Conclusion

An adaptive background approach was presented. Gaussian distributions were used to model any other or third pixel in the image in our system. Our process is quicker than the original system, according to the findings. The ability to track moving areas and the amount of noise in the binary motion picture are identical to the original system's properties. Our method can be implemented in a real-world video surveillance framework and run on regular computers due to its speed and robustness. We focused on the algorithm's speed, so some other issues, such as slow learning at first or too quick adaptation of still objects, would need to be addressed in the future.

References Références Referencias
Research on the Cultivation of Talents for the Integration of Production and Education of Computer Software Technology Based on the Concept of CDIO

By Xia Shen, Changwei Xie & Zhangjie Yuan

Chongqing City Vocational College

Abstract- According to the development and reform of CDIO concept in China in recent years, we can know that it can greatly improve the scientific quality and systematic quality of talent training mode in China's education industry[1]. At present, the continuous improvement and innovation of computer software technology makes our education industry constantly appear the hope of reform. Some experts believe that the industrial economy of computer software technology has a bright future. According to the application of the combination of industrial economy and education, we can find that in theory, the application of CDIO concept can help the integration of production and education of computer technology and establish a perfect talent training mode. This paper will provide the corresponding conclusions.

Keywords: CDIO, integration of production and education, personnel training. software technology.

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Keywords: CDIO, integration of production and education, personnel training, software technology.

I. Introduction

We often say that the talent training mode refers to the system of talent training objectives, training standards and training process. Through the optimized combination of different components, we can build a lot of different training modes[2] . Computer science is a new technical industry in China in recent years. Relevant experts suggest that we can carry out multiple training of different forms of computer talents by strengthening the management of teaching reform and innovative experiment projects and carrying out extracurricular activities of CDIO project. In order to improve the ability of engineering practice and innovation of college students. At present, China is strengthening the transformation of the new mode of economic progress. Strive for the information technology industry to promote the interaction of industrialization and Industrialization to promote the information technology industry. As a popular information technology major, the emergence of computer science makes the economic progress of information industry faster and faster. With the occurrence of China's education reform and the emergence of CDIO concept, the new mode of talent training of computer professional integration of production and education has emerged. There is no doubt that this will lead to the establishment of a new chapter in the education reform of Computer Science in China.

II. The Main Theory of Production Education Integration based on Computer

a) Industrial economy and educational ideas

The integration of industry and education refers to the development of the integration of industrial economy and education concept of an industry[3]. Generally speaking, the object of the concept of integration of production and education is a relatively clear target industry. Moreover, the establishment cycle of its industrial chain can not be too long. We can think that the industry that can obtain the integration of industry and education belongs to the innovative industry in the new era. Generally speaking, this industry will be recognized by the national education department.

b) The supporting idea of computer industry education integration

According to the above description, we know that the computer industry economy is an innovative industry with short development cycle in the new period. If it can obtain the support of industry education integration, it will be recognized by the Ministry of education. Then we can think that the development of computer software technology industry economy is prosperous and prosperous. Under the influence of social environment, the progress of computer major in school has also been concerned by people. The combination of industrial economy and educational ideas is essentially the combination of practical requirements and theoretical knowledge. There is no doubt that this combination can implemented (see Figure 1).
c) National support for the combination of production and education of computer

The development of computers makes it obvious to all. Compared with the traditional engineering industry, the progress of computer industry is also very rapid. As its application technology is closely related to our life, its update has also been strongly supported by the state. Similarly, computer related industrial economy has become an important part of China’s national economy[4]. Therefore, its national support for the combination of production and education is relatively strong.

III. Problems Existing in the Cultivation of Talents Integrating Production and Education in Computer Software Technology Specialty

Computer software specialty is a branch of science which has the fastest progress in the field of technology. With the development of software technology and the increasing demand for the ability of talents, the traditional talent training mode of computer specialty can not be applied in today’s information environment. At present, there are many problems in the computer talent training mode of the integration of production and education in China.

a) Emphasis on theorization and weaken practice

According to a lot of research, we can find that there are a lot of software talents in our country. However, the level of their software production is generally low. We know that enterprises need high-level computer software development talents. However, the computer talents trained in Colleges and universities focus on the memory of theory and forget the significance of practice itself. This training mode is not conducive to the growth of computer talents.

b) The practical conditions can not meet the needs of personnel training

It can be confirmed that many a small part of the school computer professional students' social practice effect is good. However, the number of students majoring in Computer Science in our country is very large. We can think that most students can not get good social practice training. Of course, more often than not, schools are unable to provide students with mature practical conditions.

c) Lack of Teachers

A good teacher makes a good apprentice. The meaning of this proverb is very huge. There is no doubt that the cultivation of talents needs the support of powerful teachers. However, the lack of teachers in many schools is not the lack of teachers but the lack of teachers’ level. Although many teachers have strong academic ability, their comprehensive practical ability is not satisfactory. This kind of education will only make students fall into the cycle of focusing on theory but lacking practice once again.

IV. The Construction of Talent Training Mode based on CDIO for Computer Software Technology Specialty

a) Introduction of CDIO concept

Before using the concept of CDIO, schools need to have a deep understanding of the specific content and connotation of this concept. In fact, the concept of CDIO inherits the concept of Engineering Education in European and American countries. It systematically puts forward the standard requirements for the cultivation of operational ability. The framework of this concept is divided into four main parts. They include conception, design, implementation and operation. Today’s schools should make clear the main contents of these four parts and implement them(see Table 1).
b) According to the concept of CDIO, the construction of theoretical teaching system should be carried out

The cultivation of talents is inseparable from the construction of teaching mode. A solid professional foundation is an important cornerstone for the improvement of students’ level. It is also the foundation of the cultivation mode of CDIO concept[5]. The school should reform the teaching system according to the development of students and the structure of CDIO. This reform does not need to be too deliberate. It can be reformed on the basis of the traditional teaching system. 4.3. The establishment of the practical link of the combination of production and education based on CDIO

The combination of industrial economy and education can improve the maximum profit of enterprises. This is a business truth. The school gives students a lot of knowledge theory. Compared with the social CDIO. Only in this way can we ensure the development of the combination of theory and practice.

V. BASED ON CDIO CONCEPT OF COMPUTER SOFTWARE TECHNOLOGY PROFESSIONAL INDUSTRY EDUCATION INTEGRATION OF THE IMPORTANCE OF PERSONNEL TRAINING

a) It is conducive to the rapid rise of computer industry economy

At present, the computer industry economy is an important part of our national economy. It can be regarded as a great contribution to the economic development of modern China. Some experts predict that the future development of computer industry is limitless. Its rise should be strongly supported by the state and the people[6].

b) It facilitates the use of CDIO’s concept of domestic innovation

In fact, the CDIO concept is a talent training concept invented by European and American countries. In recent years, due to the needs of China’s national conditions, we have introduced this concept to China. At present, our use of this concept is in imitation of European and American countries. This paper describes the establishment of the talent training mode of integration of production and education, to a certain extent, innovates the domestic CDIO concept. It is of great significance across the ages.

c) It can help promote the CDIO concept in other industries

The combination of production and teaching of computer and CDIO concept is a relatively new use of skills. Before that, there were few successful cases. In theory, the case of the combination of production and education is successful. Then it will also lay the foundation for the application of CDIO concept in the combination of production and education in other industries.

VI. CONCLUSION

The combination of production and teaching of computer and CDIO concept is a relatively new use of skills. Before that, there were few successful cases. In theory, the case of the combination of production and education is successful. Then it will also lay the foundation for the application of CDIO concept in the combination of production and education in other industries.

REFERENCES RÉFÉRENCES REFERENCIAS

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Nanoscale Modification of Weld Metal Microstructure

By Holovko V. V. & Stepanuk S. M.

Abstract- The are considered possibilities of influencing the a circular ferrite controlling content on welds metal mechanical properties. The method of adding titanium carbides to the welding bath liquid metal is considered. It is established that non-metallic inclusions with a size of 0.3 μm to 0.8 μm and titanium carbides on surface determine the conditions for the microstructure formation and the level of weld metal mechanical properties.

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I. Introduction

The possibility of welds structure forming process influence on weld metal mechanical properties is significantly limited in comparison with the technology of steel production. The main factors that can increase the weld metal strength and toughness are the solid solution alloying and the of non-metallic inclusions formation with a certain size, composition and morphology.

In order to ensure the production of steel with a circular ferrite (AF) controlled content there is a need to take into account the processes occurring in its manufacture. In 1990, the was [1] introduced the concept of "Oxide Metallurgy", which implies the use of certain non-metallic inclusions as heterogeneous nucleation centers of the structure in the crystallization process. Later, the concept of "Inclusion Engineering" was proposed to develop knowledge about the inclusions number and size distribution control in steel in the ladle processing and casting. Almost a decade later, in 2006, Grong and colleagues [2] combined the two ideas, suggesting that it was possible to use inclusion engineering to optimize the microstructure of steel to improve its mechanical properties. He called inclusions (such as oxides, sulfides, carbides, or nitrides) <1 μm in size that can promote AF formation "dispersoids." They were allocated to a special group because due to their small size they do not cause a negative influence on the reduction of mechanical properties, but affect on the metal microstructure formation.

Therefore, for the formation of a highly toughness welds microstructure it is necessary to ensure that the metal is predicted in terms of volume fraction, composition and size distribution of inclusions. This article was devoted to increase our knowledge in such problem.

II. Material and Experimental Procedure

a) Material

The chemical composition of 20 mm thick plate of HY 85 steel is listed in Table 1. This plate was obtained in the quenched and tempered condition. The yield strength of the present steel is 560 MPa. The chemical composition of the weld metals was determined by spark spectrometer.

b) Weld metal preparation

The material for the weldment used in these experiments is an HY85 steel, although some of its alloy components do not remain at the low alloy level. The chemical compositions of the weld metals and the wire electrodes are shown in Table 1. The HY85 steel plates with 20 mm thickness were welded with single V-shape of weld pool by the Flux-core arc-welding technique with gas M21 shield process. The microstructural overview of the weldment is given in Fig. 1. Nineteen weld passes were applied to complete the joining. Their profiles are shown in Fig. 2a. The voltage and the current of the welding are 35 V and 500 A, respectively.

The basic alloying system C – Mn – Cr – Ni – Mo – Si – Cu, implemented in the №0 variant, was aimed at forming weld metal with a bainitic structure with mechanical properties corresponds to low-alloy steels of strength category K75. The alloying weld metal effect with titanium was investigated on weld metal samples №4, and the introduction of titanium carbide on weld metal samples №6. Titanium compounds were introduced into the welding pool through a flux-cored wire with alloying particles no larger than 1 μm in core.

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In order to determine the impact of heat treatment on the basic mechanical and plastic properties of the tested steel, tensile testing was conducted at ambient temperature, based on the valid standard ISO 6892-1:2010 (metallic materials—tensile testing). The research was carried out on an Instron 8800 machine (Instron, High Wycombe, UK) using an extensometer to measure elongation. Proportional rectangular samples were tested with an original gauge length of \( L_0 = 35 \) mm. Testing rates were based on stress rate (Method B according to the ISO Standard 6892). Within the elastic and plastic range up to the yield strength, the strain rate was \( 0.0021/\text{s} \); after the yield strength, the stress rate exceeded 25 MPa/s until fracture occurred. In order to determine the value of the absorbed energy (KV), the notched impact strength (KCV), a Charpy impact test was performed. The study was performed in accordance with Standard ISO 148-1:2010 (Metallic materials—Charpy pendulum impact test) on a pendulum hammer using an initial energy of 300 J. Standard samples, V-notched to a depth of 2 mm, were tested. The tests were carried out after the samples were cooled to \( +20; 0; -20; -40 \) and \(-60 \) \( (\pm 0.5) \) °C and conditioned for 15 min in a mixture of liquid nitrogen and isopropanol. The temperature was monitored using a digital thermometer, and the transfer time for all samples was less than 5 s.

### Metallography and Microscopy

Weld metal samples for metallography and microscopy were prepared by traditional method, including mechanical grinding, polishing techniques and etching in 3% nital solution before being investigated by a NEOPHOT 30 Optical Microscope (OM). A JSM35CF field emission Scanning Electron Microscope (SEM) was also applied for observation. Volume fraction and size distribution of microstructural constituents were measured by quantitative metallography. For Electron Backscattered Diffraction (EBSD) test, the samples were electro-polished in a solution consisting of 12.5% perchloric acid, 87.5% absolute ethyl alcohol at 25°C under a potential of 20 V for 20 s.

### Results

As a result of metallographic analysis, it was found that the weld metals microstructure consists of phases which are austenite grains decay products and contains a number of non-metallic inclusions. The most common structures observed in the weld metal were grain boundary allotriomorphic ferrite (GAF); intragranular polygonal ferrite (IPF), which is formed in the form of upper and lower bainite; Widmanstett ferrite (WF); intragranular acicular ferrite (AF); upper and lower bainite (UB and LB); phase containing martensite, austenite and carbides (MAC). The content of the individual components of the weld metal microstructure are given in table 3.

### Table 3: Weld metal microstructure components percentage

<table>
<thead>
<tr>
<th>№ шва</th>
<th>Weld metal microstructure components (%)</th>
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<tbody>
<tr>
<td></td>
<td>GAF</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

The basic alloying weld metal system (variant №0), such as titanium alloying weld metal, provides high strength level thanks to formation a microstructure with a high content of intragranular polygonal ferrite and a allotriomorphic ferrite layers formation along the grain boundaries (Fig. 1).
Intragrain ferrite is formed both in the form of bainite phase and in the form of massive ferrite, and grain boundary ferrite is released both in the form of acicular ferrite and Widmanstätten ferrite. Non-metallic inclusions contain oxides of aluminum and silicon, which contain sulfur-based emissions. This structural composition, which has a high content of bainite phase and a relatively low content of acicular ferrite, is characterized by low plasticity (variants №0 and №4 (Fig. 2)).

The introduction of titanium particles in the form of carbides into the welding pool (variant №6) leads to a slight increase in the content of inclusions from 0.3 to 0.8 μm. In the weld microstructure allotriomorphic ferrite is released at the grain boundaries not in the form of grain boundaries layers, but as separate discrete blocks (Fig. 3). Intragrain ferrite is formed mainly in the form of upper bainite, but a decrease in grains content due to an increase in acicular morphology, which leads to increased plasticity and viscosity. The proportion of Widmanstätten ferrite is somewhat reduced, but it does not grow from layers of allotriomorphic ferrite, but in the body of grains.

![Fig. 1: Weld metal microstructure optical metallography of specimen №0](image1)

![Fig. 2: Weld metal microstructure optical metallography of specimen №4](image2)
Comprehensive analysis of inclusions (morphology, dispersion, composition) showed the influence of non-metallic inclusions on the weld metal microstructures. This influence on microstructures depends not only due to inclusions chemical composition, but also their size and distribution density in the metal matrix. Computer processing the results of the non-metallic inclusions distribution of by size and composition allowed to distinguish from the general data set three main groups on these grounds. Triple diagrams of the inclusions chemical composition up to 0.3 \( \mu \text{m} \), 0.3–0.8 \( \mu \text{m} \), and more than 0.8 \( \mu \text{m} \), which are part of these groups, are shown in Figs. 4–6 for samples №0, №4 and №6.

It has been found that inclusions up to 0.3 \( \mu \text{m} \) in size most often contain individual compounds of aluminum or titanium, sometimes such compounds are included in one. In inclusions ranging in size from 0.3 to 0.8 \( \mu \text{m} \), the bulk is composed of aluminum and titanium compounds, a small amount of manganese and silicon compounds is also possible, and sulfur compounds are found. Inclusions larger than 0.8 \( \mu \text{m} \) consist of compounds of aluminum, titanium, manganese, silicon and sulfur, and the total content of manganese and silicon may exceed 50% of the inclusion total mass.
Fig. 4: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #0 (b, c, d)

As a result of the study, it was found that single-phase inclusions type of simple oxides (\(\text{Al}_2\text{O}_3\), \(\text{TiO}_2\) and \(\text{SiO}_2\)) with a size not more than 0.3 \(\mu\text{m}\) do not affect on acicular ferrite formation. The inclusion of this size range contributes to hardening structures such as Widmanstett ferrite and upper bainite formation. Multiphase inclusions larger than 0.8 \(\mu\text{m}\), containing manganese silicates, aluminum and titanium oxides, actively promote the polygonal structural components formation in the weld metals of low-alloy high-strength steel (Fig. 7–10).
Complex inclusions (multiphase inclusions) are more efficient centers for the formation of acicular ferrite compared to simple oxides and nitrides. In weld metal of low-alloy high-strength steels in non-metallic inclusions containing two or more phases, the phase composition varies from the center to the inclusion surface.

Their influence is most noticeable in those cases when the carbide phase nanoscale formations are located on the outer surface of a multiphase inclusion 0.3–0.8 μm in size. Such morphology inclusions were noted when the titanium carbides introduce into the liquid pool outside the action zone of the welding arc (weld variant №6).

Fig. 5: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #4 (b, c, d)
Fig. 6: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #6 (b, c, d)

Fig. 7: Electronic image of specimen №0 weld metal microstructure
Figure 10 shows the results of carbon content scanning of two adjacent non-metallic inclusions and a metal matrix in the structure of the weld metal №6. The results show the carbide phase presence on the periphery of the inclusion influences on the fine ferrite structure formation.

Such inclusions are the complex, which composition is differ in the center and on the surface. If in the center, as a rule, the oxide is located, then on the inclusion surface there are islands of carbides.
In fig. 10 it can be seen that on the inclusion surface there are carbides with a size of no more than 100 nm. There are no such carbides on the inclusions surface in the metal of welds No. 0 and No. 4. Consequently, these are refractory titanium carbides and they could be fixed on the inclusions surface during the metal crystallization. Such nano-sized inclusions can influence the formation of both the primary and secondary weld metal structure.

Based on this inclusions morphology, we can assume that their center is formed at the crystallization stage, and another mass in the carbides (type TiC) form is deposited on their surface from a supersaturated solution in the interdendritic volume of metal during its further cooling.

The nanosized carbides modifying effect an increase in the acicular ferrite content in the weld metal No. 6 microstructure (Table 3) and an increase in its toughness and plasticity (Table 2). It should be noted that the carbon content in the weld metal, when modified with TiC particles, practically does not differ from the weld No. 4 alloyed with titanium, and the titanium content is lower, which leads to a slight decrease in the strength of the metal.

### IV. Conclusions

It is established that the presence a certain number of non-metallic inclusions in the weld metal is a necessary condition for obtaining a microstructure with high strength, ductility and toughness of the metal. Obtained data analysis showed the positive effect of inclusions ranging in size from 0.3 to 0.8 μm on the structure and mechanical properties metal formation. Such inclusions have a multiphase morphology and contain nanoscale carbides on the outer layer. Such inclusions have a core, usually of alumina, an outer multilayer mantle, which is based on compounds such as galaxite and titanium oxides, and on the outer surface are carbide phases. The presence of nanosized titanium carbides in the liquid metal of the welding pool has an effect on the weld metal microstructure formation. Modification of the weld metal with nanosized titanium carbides allows to increase the level of its toughness and ductility without changes in the chemical composition of the welds.

### References

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4. Stepanuk S.M. – https://orcid.org/0000-0001-8876-9153.
Introduction- There is a strong foundation for the philosophy of dialectics. First, the dialectical model described in this book originated from the philosophies of Plato, Socrates, Aristotle, and Hegel, all of whom applied the philosophy of dialectics and the dialectic method as a means of seeking and understanding the truth.

Secondly, there is a wealth of empirical data which supports dialectical behavior therapy (DBT) to be a highly effective, evidence-based model of change which helps individuals to change their thoughts, emotions, and behaviors. Throughout my years as a dialectical behavior therapist, I came to observe how the same concepts which produced change in my clients could be expanded to explain how change occurs with everyone. In search of credibility for this idea, I decided to see if there were any physical laws of nature which would support my dialectical view of the world. What I observed through my research is that dialectical processes not only explain how change occurs with people but can also explain how change occurs in our physical universe.

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I. Introduction

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After several years of research, these new findings were, in fact, shared within the scientific, resulting in recent publications in multiple peer-reviewed scientific journals:

The ultimate unsolved problem in the universe is that science cannot understand the fundamental interactions of nature: matter, energy, time, and space. The philosophy of dialectics explains how everything in the physical universe is connected through a dialectical relationship. Dialectical principles and processes explain how reality and change are created through a synthesis between opposing states. It is, in fact, the conflict, tension and friction that is created between opposing states which produce change. This book proposal has three objectives. First, it will establish a theoretical foundation and overview of dialectical processes. Second, several dialectical models will be presented. Finally, we will examine how the dialectical relationship bridges the gap between matter, energy, time and space.

II. Theoretical Foundation

The dialectical model refers to phenomenon which comprises the following paradoxical principles:

1. Everything opposes each other and simultaneously synthesizes together. Everything comprises contradictions or opposing states. According to the principles of polarity, two opposing forces can both be true. Reality is not static but comprises opposing states (a thesis and antithesis) from whose integration (synthesis) evolves a new set of opposing forces.

2. Everything is separate and simultaneously connected. According to the principles of interrelatedness and wholeness, each part of a system is of limited value unless the analysis of that system relates the part to the whole. Therefore, the identity of each part of a system exists and evolves relative to its interaction with each other part and relative to the system as a whole (quantum entanglement).

3. Opposing systems are incompatible with each other and share a continuous, transactional relationship. Change is transactional with opposing states influencing and affecting each other reciprocally. It is the friction created between the thesis and antithesis forces within each system that produces change. The new state following change (the synthesis) also comprises polar forces, and thus change is continuous.

Dialectical refers to a process in which a thesis is necessarily opposed by a contradictory antithesis, the contradiction being reconciled on a higher level of truth through a synthesis. There are three stages of development in the dialectical relationship. First, there is a thesis, giving rise to its reaction. For every action there is an equal and opposite reaction. For every action there is an equal and opposite reaction. In this way, the second stage is the development of an antithesis that, while sharing common traits, contradicts and opposes the thesis.

The third stage of development in the dialectical relationship is that as two opposing states come together, they create a distinct, new group that resolves the tension between them by means of a synthesis. This synthesis solves the conflict between the two opposing forces, namely a thesis and its antithesis, by reconciling their common truths and forming a new thesis, causing the process to begin again.
Any behavior or state can be understood as a series of linked components (represented by interlocking circles). These links are “chained” together because they follow in succession one after the other. In DBT, a chain analysis is used to identify how behavior is caused and how it changes over time. The purpose of a chain analysis is to figure out what the problem behavior is, what prompts/causes it, what its function is, what is interfering with the resolution of the problem/what maintains it, and finally to identify solutions to the problem. In this way, the dialectical process shows how change occurs over time.

In comparing the two figures above, you can physically observe how the electromagnetic wave parallels the dialectical process. The wave comprises:

- Two opposing states, a crest and trough, which oppose each other and simultaneously synthesize together.
- Each peak and trough is separate, yet simultaneously part of one greater, whole continuum and system.
- The crests and troughs share a continuous, transactional relationship with each other. In addition to the parts affecting one another, each part affects the whole system, and the whole system affects all the parts.
- The conflict, tension and friction that is created between two opposing states (peak/trough; thesis/antithesis; parts/whole) produce change. The new state following change, the synthesis, also comprises polar forces and thus change is continuous.

Dialectics tell us that opposing states exist simultaneously. Therefore, the wave exists in a quantum state and simultaneously in a state of superposition (i.e., all possible states at once). When we focus on one particular point in the wave, we are observing a quantum state (a part). When viewed as one whole continuum, what you are really observing is a superposition of states (the whole). Go back and forth between looking at the part and the whole. You can physically observe how a quantum state and superposition of states exist at the same time. The only thing that changes is your perspective.

Quantum states exist in this state of superposition because a quantum system exists independently of relativity, that is, independently of any specific point in time and space which is what separates the various quantum states. It is only when relativity is introduced into the system, e.g., the wave’s state at a specific point in time and space, that you can observe one of the many possible definite and measurable states.

Here is another example of how a system exists in a state of superposition and simultaneously in a quantum state. Consider the lifespan of the butterfly. Throughout time and space, the butterfly exists as both a caterpillar and a butterfly. However, at any specific point in time and space, it can exist only as either a butterfly or a caterpillar. A collapse does not occur because it is seen or measured. The butterfly exists throughout time and space, and simultaneously exists at a specific point in time and space.
In the figure above, you can observe how opposing quantum states exist at different points in time and space (the parts). At the same time, you can observe a superposition of states which contains all of the quantum states (the whole).

When you view the continuum in its entirety, as a superposition of states, notice the conflict which exists between opposing states. It is this tension and friction that is created between two opposing quantum states which produce change.

Dialectical processes can be observed throughout all aspects of nature and science.

- Each atom is separate and part of one greater, whole continuum or system.
- The atoms share a continuous, transactional relationship with each other.
- It is the conflict, tension and friction that is created between two (2) opposing atoms which produces a chemical change or reaction.

**Figure 4:** The Lifespan of the Butterfly

In the figure above, you can observe how opposing quantum states exist at different points in time and space (the parts). At the same time, you can observe a superposition of states which contains all of the quantum states (the whole).

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Dialectical processes can be observed throughout all aspects of nature and science.

**Figure 5:** The Atom

- Atoms comprise opposing states of protons and electrons which simultaneously synthesize together.
- Each proton and electron is separate and part of one greater, whole system.
- Protons and electrons share a continuous, transactional relationship with each other.
- The friction that is created between the opposing states produces change. The new state following change, the synthesis, also comprises polar forces, and thus change in continuous.

**Figure 6:** Molecules

- Molecules comprise a group of opposing atoms which simultaneously bond together.

- Biology comprises two opposing cells which simultaneously synthesize together.
- Each cell is separate and part of one greater, whole continuum.
- The cells share a continuous, transactional relationship with each other. Each part affects the whole system, and the system as a whole affects all the parts.
- The conflict, tension and friction that is created between two opposing cells produces change. The new state following change, the synthesis, also contains opposing cells.

**Figure 7:** Biology

- Life is created through the transaction and synthesis between dialectically opposing male and female counterparts.

**Figure 8:** Reproduction
The sympathetic and parasympathetic nervous systems comprise opposing states which simultaneously synthesize together to create one, whole continuum which is the central nervous system.

- Each part of the system has a distinct, separate function and is part of one greater, whole continuum or system.
- Opposing parts share a continuous, transactional relationship with each other.
- The conflict, tension and friction that is created between opposing parts produces change.

The brain consists of 2 hemispheres which oppose each other and simultaneously synthesize together.

- The brain consists of opposing parts with distinct, separate functions while simultaneously being part of one greater, whole system.
- Opposing parts of the system share a continuous, transactional relationship with each other.
- The conflict, tension and friction between opposing parts create change in the whole system, and the whole system simultaneously affects all other parts of the system.

DNA comprises two opposing strands which simultaneously synthesize together.

- Each strand is separate and part of one greater, whole continuum.
- The strands share a continuous, transactional relationship with each other.
- The conflict, tension and friction that is created between the opposing strands produces change.

Quantum states oppose each other while they simultaneously synthesize together. They synthesize together through a synthesis of common truths (for instance, they are all part of the same system).

- Each quantum state is separate and part of one greater, whole continuum or system.
- The conflict, tension and friction that is created between two opposing states produces change.
- The new state following change, the synthesis, also comprises polar forces, and thus change in continuous.

This exact process can be seen in evolution. Notice how adialectical perspective allows you to simultaneously observe the separate quantum states.
(the parts) and a superposition of states (the whole). If you go back and forth between the two opposing perspectives, you can observe the relationship between a quantum state and a state of superposition.

Figure 13: Evolution

Figure 14: The Fundamental Interactions

The fundamental interactions of the universe share a dialectical relationship with each other.

- The electroweak interaction is created through a synthesis between opposing electromagnetic and weak interactions.
- Nuclear interactions are created through a synthesis between opposing strong and weak nuclear interactions.
- Electromagnetism is created through a synthesis between opposing electric and magnetic charges.
- The gravitational field is creating through opposing states of time and space.

Figure 15: Space-Time

- Space-time consists of separate units or parts which oppose each other and simultaneously synthesize together to create one greater, whole continuum and system.

- Time and space share a continuous, transactional relationship with each other.
- It is the conflict, tension and friction that is created between time and space which produces change.
- The new state following change, the synthesis, also comprises polar forces, and thus change is continuous.

Figure 16

- Dialectically, the universe exists on one continuum of finite-infinite. It is finite at any specific point or realm of space-time (the parts), and simultaneously infinite in its quantum state of superposition (the whole).
- The beginning of time and space, and the end of time and space, are separate, opposing states or parts which simultaneously synthesize together to create one, whole continuum or superposition of states.

III. A DIALECTICAL INTERPRETATION OF MATTER, ENERGY, TIME AND SPACE

A dialectical interpretation of matter, energy, time, and space shows how everything in the physical universe is created by and connected through a dialectical relationship, that is, a synthesis between opposing states. Dialectical principles and processes explain how reality and change are created through the conflict, tension, friction and ultimate synthesis between opposing states.

For instance, opposing states of mass (an objects resistance to motion) and the speed of light\(^2\) (a state of motion) synthesize together to create energy. Opposing states of particles and antiparticles synthesize together to create matter. Opposing states of the past and the future synthesize together to create present time. Opposing states of position and direction synthesize together to create space. Opposing states of matter and energy synthesize together to create quantum physics, while time and space synthesize together to create relativity.
IV. How Does Quantum Physics and Relativity Synthesize Together?

Everything in the universe comprises all or some of energy, matter, space, and time. As these four states come together, they create 13 possible states of reality: 1) all possible states at once; 2) space, matter, and time; 3) matter, time, and energy; 4) space, time, and energy; 5) matter, energy, and space; 6) space and matter; 7) matter and time; 8) time and energy; 9) space and energy; 10) space; 11) matter; 12) time; 13) energy. This figure below illustrates all possible logical relationships between a finite collection of sets, namely energy, matter, time, and space.
Through the dialectical relationship, four (4) states come together to create 13 possible states. You can observe that the nine (9) new states were created through a synthesis between opposing states.

As a quantum system and relativity come together, they create a distinct, third group that resolves the tension between them by means of a synthesis. This synthesis solves the conflict between two opposing states (a thesis and antithesis) by reconciling their common truths. Speed is the one common trait or denominator that links quantum physics and relativity. (Quantum physics comprises energy and that energy contains speed. Relativity comprises time and that time contains speed).

There are 10 possible states of reality that contain either energy or time and therefore contain speed. As matter (M), energy (E), time (T) and space (S) intercept, quantum physics (M ∪ E) becomes a set that contains 11 elements (nine states that contain speed, one state that contains space and matter, and one state of matter). Relativity (T ∪ S) becomes a set that contains 11 elements (nine states that contain speed, one state that contains space and matter, and one state of space). Reconciling the states that contain the common trait of speed results in 10 possible states of reality coming together to form states 1, 2, 3, 4, 5, 7, 8, 9, 12 and 13. According to dialectical principles, reality is created through a union or synthesis of states that contain the common, interlocking trait of speed.
The resolution of the conflict (synthesis) forms a new thesis, starting the process over again. Quantum physics and relativity exist on opposing ends of one whole continuum, and they share a dialectical relationship as they:

- Oppose each other and synthesize together.
- Are each separate states and parts of a greater whole.
- Are incompatible and share a continuous, transactional relationship with each other.

The problem with combining quantum physics and relativity is that relativity gives nonsensical answers when scaled down to quantum size, eventually descending to infinite values in its description of gravity. Likewise, quantum physics runs into serious trouble when blown up to cosmic dimensions, piling so much energy in the quantum field that it creates a black hole that causes the universe to fold in on itself. The dialectical relationship, which excludes states 6, 10, and 11 from the synthesis, subtracts tiny particles of matter and huge gravitational fields of space, thereby bridging the gap between quantum physics and relativity.

V. A DIALECTICAL INTERPRETATION OF THE STANDARD MODEL AND GRAVITY

The standard model and gravity share a dialectical relationship with each other. A transaction occurs between a thesis (quantum system of electromagnetic, strong and weak interactions) and anti-thesis (space-time). Similar to a set of meshing gears transmitting rotational motion, it is the conflict, tension and friction that is created between a thesis (quantum system) and anti-thesis (space-time) in each system which produces change. The new state following change, the synthesis, also comprises opposing forces which contain a new thesis and anti-thesis, causing the process to begin again.
I can’t think of a better experiment to test this hypothesis than Schrodinger’s famous cat in a box which remains the defining benchmark for modern interpretations of quantum mechanics.

VI. **A Dialectical Interpretation of Schrödinger’s Cat**

Existence comprises two opposing states of **life** and **death**. They exist on opposite ends of one continuum we can name the cat’s lifespan. Life and death and all the states between them exist in a state of superposition because a quantum system exists independently of relativity, that is, independently of any specific point in time and space which is what separates the different quantum states between life and death. Once relativity is introduced into the system, that is, the cat’s state of existence at any specific point in time and space, such as when an observer opens (or does not open) the box, then you can observe a single quantum state. And while it appears as though a wave collapses, as we have seen, opposing systems are actually co-existing at the same time. The cat exists in all possible states at once (as a whole system) and simultaneously exists in individual, evolving quantum states (which makes up the separate parts).

A dialectical interpretation of quantum mechanics suggests that the state of Schrodinger’s cat is created through the synthesis between opposing states. On one side we have the cat’s quantum state (thesis). On the other side we have a specific point in time and space from which an observation, measurement, or some other event occurs (antithesis). The conflict, tension and friction that is created between these two opposing states produces change. The new state following change, the synthesis, also comprises opposing parts, and thus change is continuous.

The birth of Schrödinger’s cat and the death of Schrödinger’s cat also share a dialectical relationship with each other as they:

* Oppose each other and synthesize together.
* Are each separate states or parts which also exist simultaneously as one, whole continuum or superposition of states.
* Are incompatible and share a continuous, transactional relationship with each other.

If reality is created through a specific point in time and space independent from an observer, how does that explain observer effects?

VII. **Observer Effects**

When an observer is present, there is an interaction, transaction and synthesis between a quantum state and that observer. The conflict, tension and friction between the quantum state (thesis) and observer (antithesis) create change.

An observation does affect a system, and observer effect therefore does exist. However, just because an observer interacts with and affects a system, one cannot conclude that material objects do not have definite properties prior to being measured.

Dialectically, opposing systems or realities exist simultaneously. In fact, there are three (3) states of reality: an objective state, a subjective state, and a synthesis between the two. These three states of reality explain observer effects.
VIII. States of Reality

Subjective reality is relative to our individual life experiences and perceptions and separates us from each other. Objective reality exists independently of our individual life experiences; objective reality connects us to each other.

Objective and subjective reality share a dialectical relationship. Reality is created through a synthesis of common, interlocking truths between opposing objective and subjective states of reality. For instance, if a tree falls in a forest and no one is around to hear it, then the synthesis of common, interlocking truths between opposing objective and subjective states of reality is, “A tree falls in a forest, and no one is around to hear it.” In this way, a synthesis of common, interlocking truths creates a higher truth.

Objective and subjective reality share a dialectical relationship as they:
- Oppose each other and synthesize together.
- Are each separate states and parts of a greater whole.
- Are incompatible with each other and share a continuous, transactional relationship.

The synthesis in a dialectic contains elements of both the thesis and antithesis, so that neither of the original positions can be regarded as absolutely true. The synthesis always suggests a new antithesis and thus acts as a new thesis. Therefore, there is no absolute truth. Rather, truth evolves, develops and is construed over time. Opposites can, however, be integrated to form a closer approximation of the truth.

IX. Cognitive Systems

- Cognitively, we process information dialectically as we continuously synthesize new information into our current beliefs.
- It is the conflict, tension and friction that is created between our current beliefs (thesis) and new information from our environment (antithesis) which produce change.
- The new state following change, the synthesis, also comprises contradictory or polar forces and thus change in continuous.

Physical and cognitive systems share a dialectical relationship with each other as they:
- Oppose each other and synthesize together.
- Are each separate states and parts of a greater whole.
- Are incompatible with each other and share a continuous, transactional relationship.

Reality is the transaction and synthesis between a physical system (thesis) and cognitive system (antithesis). The conflict, tension and friction that is created between these two opposing systems produces change. The new state following change, the synthesis, also comprises polar forces and thus change is continuous. That is, what we do influences and changes our environment and other people in it. The environment and other people influence and change us. The resulting changes become a new thesis and antithesis and so on. This is how reality and change occurs over time.

X. A Dialectical Interpretation of Quantum Consciousness

Each part of a system is of limited value unless the analysis of that system relates the part to the whole. Therefore, the identity of each part of a system exists and evolves relative to its interaction with each other part and relative to the system as a whole.

Every whole system contains parts. Consider time, for instance. Every second in time is a separate moment. At the same time, you can observe how seconds of time expand out to minutes, minutes to hours, hours to a day, days to weeks, weeks to years, years to centuries, and so on. Imagine the highest or greatest period of time, that which encompasses “all of time”. This is the superposition of time, and it contains the whole and highest truth of reality throughout all of time.

Space expands, too, from the home where you live to your city to your country to our world and to “all of space.” This superposition of space contains within it the whole of space. We expand, from individuals to families to communities around the world to a collective whole or “all of us”.

In this way, across time and space, separate physical systems synthesize together to create one greater, whole system, that which contains all knowledge and truth. And while that truth is in a state of constant change, this ultimate synthesis or superposition of states creates our highest truth or consciousness.
Consciousness, as with all things, exists on a continuum. On one end of that continuum exists the lowest possible state of consciousness, and on the other end exists the highest possible state of consciousness. Here are some differences between them.

<table>
<thead>
<tr>
<th>Lower Consciousness</th>
<th>Higher Consciousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of the physical world</td>
<td>Awareness of physical and non-physical connections (for example, awareness of causal factors of behavior over time)</td>
</tr>
<tr>
<td>Awareness of self</td>
<td>We are also entangled</td>
</tr>
<tr>
<td>Awareness of self in relation to others</td>
<td>Awareness of the present in relation to the past and the future</td>
</tr>
<tr>
<td>We are separate</td>
<td></td>
</tr>
<tr>
<td>Awareness of the present</td>
<td></td>
</tr>
<tr>
<td>Awareness of a part</td>
<td>Awareness of an collective whole</td>
</tr>
<tr>
<td>Relative to a specific point</td>
<td></td>
</tr>
<tr>
<td>Awareness of the “whole” of time and space</td>
<td></td>
</tr>
<tr>
<td>We oppose each other</td>
<td>We are also connected</td>
</tr>
<tr>
<td>We exist in single states</td>
<td>We also exist in a superposition of states</td>
</tr>
<tr>
<td>We are egocentric</td>
<td>We are also empathic and altruistic</td>
</tr>
<tr>
<td>We are temporary/finite</td>
<td></td>
</tr>
<tr>
<td>Truth is as I see it</td>
<td>Opposing experiences of reality can be integrated to form a closer approximation to the truth</td>
</tr>
</tbody>
</table>

We each share a dialectical relationship with each other. Reality is created through the continuous synthesis of common, interlocking truths (beliefs) that we share with others. As common truths are reconciled, we form new groups or higher truths. The identity of each part of a system, namely each person’s reality, exists and evolves relative to its interaction with each other part, namely every other person’s reality, and relative to the system as a whole. We all exist within a spiral continuum of dialectical change. Reality is ever changing, creating a ripple effect, and change is transactional with a cause and effect, not dissimilar to a funhouse of mirrors reflecting and bouncing back and forth off each other throughout infinity. In this way, each of us is a reflection and extension of each other and part of a greater whole or truth. Everyone has his or her own separate truth. At the same time, reality is the synthesis of common, interlocking truths and is what connects us to each other. In this way, this synthesis of common, interlocking truths creates a higher truth.

When we refer to consciousness or awareness, we are actually talking about a non-physical state of existence. Physical and non-physical systems oppose each other. At the same time, science has found that physical and non-physical states are identical in several ways, for example:

- Time is an illusion (Einstein proved that time is relative).
- Matter is an illusion (Atoms consist of energy and waves).

- Death is merely a change in form (Energy cannot be created or destroyed, it can only be changed from one form to another.)

  In these ways, the ultimate reality between physical and non-physical states are identical.

  How can two states, the physical and the non-physical, possess traits which are completely opposite in nature while simultaneously still being one and the same?

  Physical States and Non-Physical States (i.e., Consciousness) share a Dialectical Relationship with each Other

  Physical states and non-physical states (i.e., states of consciousness) are opposing states which exist along one continuum. Physical states and states of consciousness share a dialectical relationship as they:

  - Oppose each other and synthesize together.
  - Are separate states and part of one, greater whole continuum or system.
  - Are incompatible with each other and share a continuous, transactional relationship.

  For instance, the level of consciousness one has is going to influence the decisions they make which, in turn, influences the physical world. For instance, if one’s level of consciousness is lower, then their priorities will lean toward creating money and power for themselves (a part) and that will impact the physical world around them (the whole). If one’s level of consciousness is relatively higher, then their priorities will lean more toward reducing suffering in the world and improving the quality of other people’s lives. In this way, consciousness produces change in our physical world. Like a pendulum, one’s level of consciousness is in a
single, continuous state of motion, fluctuating back and forth between the two opposing ends of one whole continuum. This is the dialectical process.

Reversely, one’s physical environment, what one is taught or exposed to, as well as biological factors, will impact one’s state of consciousness. In these ways, our consciousness and the physical world share a dialectical relationship with each other.

As two opposing states, a physical state and a state of consciousness, come together, they create a distinct, new group that resolves the tension between them by means of a synthesis. This synthesis solves the conflict between the two opposing forces, namely a thesis and its antithesis, by reconciling their common truths and forming a new thesis, causing the process to begin again.

Since a physical state and a state of consciousness share this dialectical relationship, understanding how our physical universe works can help us to better understand consciousness. Remember how we could shift our perception from a quantum state (the part) to a state of superposition (the whole). That is exactly what we do to increase our level of consciousness. For instance, when one prays or meditates, what they are actually doing is shifting their perception from looking at themselves (a part) to looking toward a higher truth (the greater whole). This shift between two perceptions (the part vs. the whole) creates conflict and tension. The resulting friction produces change in the system through a synthesis. This change or shift in perception is subtle but powerful, changing one’s reality as they move along the continuum of consciousness.

XI. Planes of Existence

Dialectically, there are three (3) planes of existence: the physical, the non-physical (consciousness) and the synthesis between the two. The physical world and consciousness exist simultaneously at opposing ends of one whole continuum or system. The synthesis between a physical state (thesis) and a non-physical state (antithesis) creates the mental plane of existence.

- The mental plane comprises opposing physical and non-physical (i.e., consciousness) planes which simultaneously synthesize together.
- The physical and non-physical planes are separate and part of one greater, whole continuum or system.
- The physical and non-physical are incompatible systems which simultaneously share a continuous, transactional relationship with each other.
- The conflict, tension and friction that is created between the two opposing planes produce change. The new state following change, the synthesis, also comprises opposing states, and thus change is continuous.

![Figure 22: Planes of Existence](image-url)
The "wave function collapse," as used herein, is different from our current interpretation in the following way. In our current interpretation, the wave function—initially in a superposition of several states—reduces to a single state due to interaction with the external world (e.g., an observation). This supposedly occurs without any understanding as to why or how or when. A dialectical interpretation suggests that the wave function exists in a state of superposition of several states and simultaneously as a single state. There is no "initial superposition" or "reduction" of states (the "collapse"). Rather, the wave function collapse more simply and elegantly refers to a single quantum state (a part) which simultaneously exists within one, greater continuum or superposition of states (the whole).

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XII. Conclusion

Matter, energy, time, and space have one common denominator. The universe exists through all things being interwoven within dialectical forces. A dialectical interpretation of the universe takes a paradoxical approach to understanding our world’s greatest paradoxes. It explains why no matter how hard science tries, it cannot find a single particle which exists on its own to explain our universe. Rather, it shows us how reality and change are created through the synthesis between two opposing states.

According to Thomas Kuhn, arguably the most influential philosopher of science of the 20th century, the evolution of scientific theory does not emerge from the straightforward accumulation of facts but rather from a
set of changing intellectual circumstances and possibilities. This is known as a paradigm shift. Science is wary of paradigm shifts. This is understandable. A paradigm establishes the foundation for legitimate work and is necessary for normal science to be uncritical. If all scientists were critical of a theory and spent time trying to falsify it, no detailed work would ever get done.

At the same time, Kuhn explains how research is so detailed and focused that one can expect to turn up anomalous experimental and theoretical results. One might reasonably argue that our inability to understand the fundamental interactions of the universe is an example of such an anomaly. When existing assumptions about reality have been shown to break down, this has usually been dealt with by changing our understanding of reality to a new one that remains self-consistent in the presence of the new evidence.

As inherently necessary as scientific paradigms are, in reality, they are really only models, and models are based on interpretations. Everything in the universe is in a state of constant change, including interpretations, models, and even our laws of physics. For instance, theories regarding our laws of nature fall into two, quite distinct schools. One side denies that laws of nature are "physically necessary. The other side argue that there is physical necessity. Our laws of nature contain two separate sets rules which oppose each other. Our laws of nature simultaneously synthesize together as these two competing theories agree on 5 conditions necessary for a statement’s being a law of nature. Our laws of nature share a dialectical relationship with each other. It is the tension, conflict and friction between theories which produce change.

We arrive at scientific laws through a process of logic and evidence. Logic (theory) and evidence (observations) are the two, and only two, pillars upon which scientific knowledge is based. Theories provide meaning and significance to what we observe, and observations help validate or refine existing theory or construct new theory. In science, theories and observations are interrelated and cannot exist without each other. The goal of theory-testing is not just to test a theory, but possibly to refine, improve, and extend it. Logic and evidence are two complimentary halves of the research cycle that constantly iterates between theory and observations. It is this synthesis between two opposing states which produces or creates change.

Physics studies the physical world. Metaphysics is that which is beyond physics. While completely opposite, they share the following similarities.

- Both are branches of the discipline of physics.
- Both are concerned with interpreting theory in physics.
- Both physics and metaphysics are concerned with describing our reality, to give an account of what the world is like.

In this way, the physical and metaphysical share a dialectical relationship, sharing common, interlocking truths while simultaneously maintaining opposing forces. The relationship between the physical and the metaphysics is in constant change. For example, with advances in technology and knowledge, some metaphysical ideas may suddenly become testable, in which case the ideas have a chance of becoming integrated into physics. (The EPR paradox is an excellent of this.) Also, recent phenomenon involving some predictions of modern speculations which have become so difficult to test that is an open question whether it is feasible that they can be tested at all. Here, the boundary between physics and metaphysics is fuzzy. There is no absolute of what is metaphysical and what is physical, no possible way to separate them. They are two parts which exist at opposing ends of one whole continuum or system. In all of these ways, scientific research itself evolves through dialectical processes.

The synthesis in a dialectic contains elements of both the thesis and antithesis, so that neither of the original positions can be regarded as absolutely true. The synthesis always suggests a new antithesis and thus acts as a new thesis. Therefore, there is no absolute truth. Rather, truth evolves, develops and is construed over time. Kuhn describes how the scientific paradigms preceding and succeeding a paradigm shift are so different that their theories are incommensurable—the new paradigm cannot be proven or disproved by the rules of the old paradigm and vice versa. Most importantly, according to Kuhn, paradigm shifts are necessary for science to progress.

At the same time, we are hardwired to resist change. Part of the brain—the amygdala—interprets change as a threat and releases the hormones for fear, fight, or flight. Your body actually protects you from change. It is natural to resist change, and science is certainly no exception to that rule, especially when that change runs contrary to one’s own belief system or research.

Truth is paradoxical. Contradictions between our current understanding of the universe (thesis) and dialectical principles (anti-thesis) do not cancel each other out or dominate each other but rather exist side by side, inviting participation and experimentation. It is this conflict, tension, and friction that is created between opposing ideas which produce change (synthesis). As every action (change) has an equal and opposite reaction, the greater the conflict, tension and friction, the greater the change produced. I think Aristotle best describes this dialectical process. “It is the mark of an educated mind to be able to entertain a thought without accepting it.”
XIII. Afterword

Empirical research has found that Dialectical Behavior Therapy (DBT) helps patients with severe emotional, mental, and behavioral disorders (persons with chronic self-harm, suicidal and/or violent behaviors) to reduce or eliminate these behaviors completely. It does so by teaching them how to shift their perspective, resolve conflict, and create positive change, for instance, by:

- Integrating extremes in thinking, feeling, and behaving.
- Integrating their views with opposing views to find the higher truth.
- Integrating objective and subjective reality (reversely, learning how to differentiate the two) in order to see reality as it really is as opposed to our interpretations of it.
- Integrating logic/reason/facts with thoughts/beliefs/emotions (reversely, learning how to differentiate the two).
- Understanding the relationship between themselves (the parts) and others (a greater whole system) and how we are connected to each other.

Throughout my training and work as a dialectical behavioral therapist, I observed that the same dialectical processes which produced change in my patients could be expanded to explain how change occurs with everyone. I came to believe, ‘If an understanding of dialectics can help resolve conflict and reduce suffering in my patients, then expanding and applying the same principles on a greater scale would reduce extremes in our world on a more universal level.’ Opposing experiences of reality can be integrated to form a closer approximation to the truth, thereby reducing conflict, hate, and violence.

My original objective in researching dialectical processes is that I wanted to see if there were any physical laws of nature which would support my dialectical view of the world. In the process of my research, what I learned is that the concept of the dialectic originated centuries ago and was developed by our world’s greatest philosophers as a means of finding the truth. It has continued to develop throughout our world history, all the way up to the present time, where it is currently being used as a popular and evidenced based model of change.

What I observed through a dialectical lens is a surprisingly consistent, all-encompassing pattern of relationships in our physical universe which can be seen throughout all aspects of nature. The scientific community is just now starting to take a closer look at this pattern as evidenced by multiple recent and ongoing publications in peer-reviewed, scientific journals.

Dialectical concepts provide potential answers to many, still unanswered questions related to reality, our universe, and our existence. They create potential for enormous scientific understanding and progress. More importantly, if successfully applied and expanded, dialectics create infinite potential for creating change toward a more peaceful and humanitarian world.

Acknowledgement

Marsha Linehan is the creator of dialectical behavior therapy. I received my training in dialectics from her training institute, Behavioral Tech, located in Seattle, Washington, United States. Behavioral Tech is the foremost expert on dialectics.
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Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

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Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.
6. **Bookmarks are useful:** When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. **Revise what you wrote:** When you write anything, always read it, summarize it, and then finalize it.

8. **Make every effort:** Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. **Produce good diagrams of your own:** Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. **Use proper verb tense:** Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. **Pick a good study spot:** Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. **Know what you know:** Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. **Use good grammar:** Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

14. **Arrangement of information:** Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. **Never start at the last minute:** Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. **Multitasking in research is not good:** Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. **Never copy others’ work:** Never copy others’ work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. **Go to seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. **Refresh your mind after intervals:** Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.
20. **Think technically:** Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. **Adding unnecessary information:** Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. **Report concluded results:** Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. **Upon conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

**Informal Guidelines of Research Paper Writing**

**Key points to remember:**

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

**Final points:**

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

**The introduction:** This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

**The discussion section:**

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

**General style:**

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

**To make a paper clear:** Adhere to recommended page limits.
Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don’t address the reviewer directly. Don’t use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.
The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

**Approach:**

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

**Procedures (methods and materials):**

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

**Materials:**

*Materials may be reported in part of a section or else they may be recognized along with your measures.*

**Methods:**

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

**Approach:**

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

**What to keep away from:**

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.
Results:
The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:
- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:
- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:
As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:
If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:
The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

**Approach:**

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

**The Administration Rules**

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

*Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.*

**Segment draft and final research paper:** You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

**Written material:** You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.
### Criterion for Grading a Research Paper (Compilation)

**By Global Journals**

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

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