

ORIGINAL ARTICLE

A Study on the Observer Psychological Change in accordance with Index of Greenness in Landscape Planting Space

Jeong-Ho Kim¹⁾, Yu-Hwan Seo²⁾, Yong-Han Yoon¹⁾, Chang-Hun Joo^{3)*}

¹⁾*Department of Green Technology Convergence, Konkuk University, Chungju 380-701, Korea*

²⁾*Department of Forest Science, Konkuk University, Chungju 380-701, Korea*

³⁾*National Forestry Cooperative Federation, Forest Inventory Center, Daejeon 306-808, Korea*

Abstract

The object of this research is to find out the psychological change of observer according to the index of Greenness in the space of scenic planting, and research is proceeded with total 112, male students 69, and female students 43. The index of Greenness experimented with 5 pictures, 20%, 40%, 60%, 80%, and 100%, and carried out the test after selecting each picture of the index of Greenness for landscaping in Konkuk University Global Campus. To find out the mood condition of testee, POMS and SD was used for analyzing. As a result of TMD among POMS, male and female students are shown as each 60% > 100% > 40% > 20% > 80% in order. As a result of SD, male and female students are shown as 80% > 20% > 40% > 60% > 100% in order and the index of Greenness 100% makes people feel fluent and natural about plants but closed and constrained than the index of Greenness 80%.

Key words : Profile of mood states, Semantic differential, Student, Plant

1. Introduction

Transfer of environment paradigm and interest and desire about quality of life and pleasant city environment of recent resident are increasing at the same time. To satisfy this, the problem of city environment and green space of park need to be understood and tried for improvement of quantity and quality of green space. Especially As creating pleasant city environment diversified efforts and plans are considered for promoting qualitative improvement of urban resident(Lee, 2004). Realization about landscape space is gradually changing with creation of pleasant

city environment and efforts for qualitative improvement of urban resident. Landscape space is like the place of origin of happiness feeling sensuously in life and is recognized as space of identifying the balance with self and nature and moreover, it is recognized as space of harmony with vitality from green organism like trees(Kim, 2005).

Change of recognition about landscape space is researched with green landscape and health. Kaplan and Kaplan(1989) claimed that nature and green landscape is arousing concentration of people and psychological tiredness is releasing through routine life because this concentration is not intentional. That

Received 12 June, 2014; **Revised** 18 September, 2014;

Accepted 29 September, 2014

***Corresponding author** : Chang-Hun Joo, National Forestry Cooperative Federation, Forest Inventory Center, Chungbuk 380-701, Korea

Phone: +82-43-840-3531

E-mail: randb2002@hanmail.net

© The Korean Environmental Sciences Society. All rights reserved.

© This is an Open-Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

is, complicated thoughts are removed through nonspontaneous caution about nature and green landscape and psychological tiredness and stress are releasing because of recharging and is arousing positive mental state(Yi and Yi, 2006). Also nature and green landscape is researched as reducing negative emotion such as horror, resentment, aggression, tension and anxiety and increase positive emotion(Ulrich, 1991; Hartiga *et al.*, 1991).

Recently, the research about green landscape is achieving in the view of various points and index of Greenness is used as one of the evaluating index related to this green landscape. Index of Greenness is 'ratio of increasing the life of plant in clock of standing human in certain spot', supplement the limitation of green area ratio as two-dimensional and horizontal concept using widely, and is an index showing directly human cenesthesia, and is an index expressing quantity of stand area of plants making verticality in the view of human. Index of Greenness is as plan index, and used example primarily is estimated as the third Tokyo long-term plan, and introduced as index in several local government after that, and actively used as index of street park in green basic plan as official plan of Japan(Jo, 2003).

Index of greenness affects more than ratio of green coverage about satisfaction of greenness(Yoon, 1993), and is a factor affecting preference and satisfaction of landscape. Index of Greenness is understood method visually of existing quantity of green, usually play emphasis on utility of green corresponding psychological desire. That is, it means the total amount of visual green in special space. this measurement of visual amount is researched as the side of city scenery, and measured using slides and pictures generally.

This study uses Index of Greenness as a one of the new index to evaluate landscape, and look outdoor scenic planting space and uses Profile of Mood States and Semantic Differential which is psychometric instrument and analyzes the change of observers

according to the index of greenness and tries to use as basic data for creating scenic planting space on psychology of human from now on.

2. research scope and method

2.1. selection of research subject and picture with index of greenness

Target of research is selected scenic planting space of Konkuk University Global Campus in Chungju, Chungcheongbuk-do , and calculated green area / total area for selecting the picture with Index of Greenness corresponding experiment after shooting total 60 places, experiments is proceeded using the pictures of 20%, 40%, 60%, 80%, 100% calculated like Fig 1.

2.2. selection and experiment method of testee

The experiment was proceeded with target of total 112, male 69, female 43 who are psychological and physical healthy and no medical history accepting experiment to students in Konkuk University global campus to find out the psychological change of observers according to the index of greenness. Before starting experiment, the object of experiment and measurement details and methods are explained enough through whole orientation, and took advanced practice about place and method of experiment. the ingestion of alcohol and caffeine was limited, immoderate exercise needs to be avoided and deep sleep needs to be taken as the caution of experiment (Kim *et al.*, 2013). Experiment was separated in each 2 groups and after starting it, psychological measurement was proceeded after appreciating for 5 minutes enough of randomly selected picture of index of greenness.

2.3. psychometric instrument

As a psychometric instrument in this research, POMS(Profile of Mood States) and SD(Semantic Differential) were used, since POMS is developed in

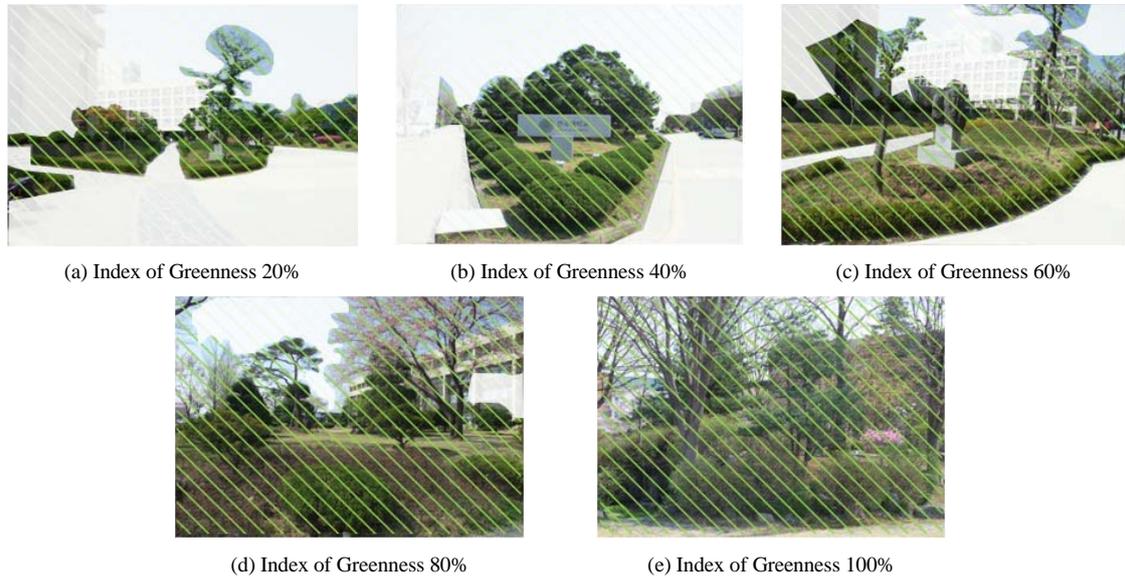


Fig. 1. Pictures used in the experiment index of greenness.

1964 as evaluating method of mood or emotional condition, it is used widely in research to predict the change of mood for effect by environment and by human relationship(McNair and Lorr, 1964). As details of an index to evaluate the temporary emotion and mood, it is scoring questionnaire separated in 6 mood criterion, T-A(Tension and Anxiety), D(Depression), A-H(Anger and Hostility), V(Vigor), F(Fatigue), and C(Confusion). Also TMD(Total Mood Disturbance)

analyzes based on 6 mood criterion. All TMD is a score subtracted V from item of all score, that is, TMD is based on formula $TMD = 'T-A' + 'D' + 'A-H' + 'F' + 'C' - 'V'$ and is calculated, The higher figure of TMD shows negative emotion, the lower it shows positive emotion. In the case of POMS, SPSS statistic program was used to analyze with significance level $p < 0.01$ by matching sample T-testing method.

In addition, the value of SD is changed by personal

Table 1. The items of the semantic differential(SD)

Number	Item	Number	Item
1	pleasant	11	cool
2	clean	12	open
3	relax	13	lazy
4	familiar	14	natural
5	bright	15	fine view
6	likable	16	safe
7	fresh	17	mild
8	distinct	18	fascinating
9	harmonious	19	calm
10	plant-mucho	20	quiet

and subjective preference and taste and SD is widely used in evaluating landscape which is a hard factor to quantify. In the case of SD, it has adjective which expresses human emotions with evaluating space of image, and evaluated the landscape using adjective 20.

3. Result and consideration of research

3.1. The result of POMS analysis

3.1.1. The POMS result of male students

POMS result of male students among testees is like Fig 2, and as analysis result of T-A showing negative emotion, green area ratio 80% shows the

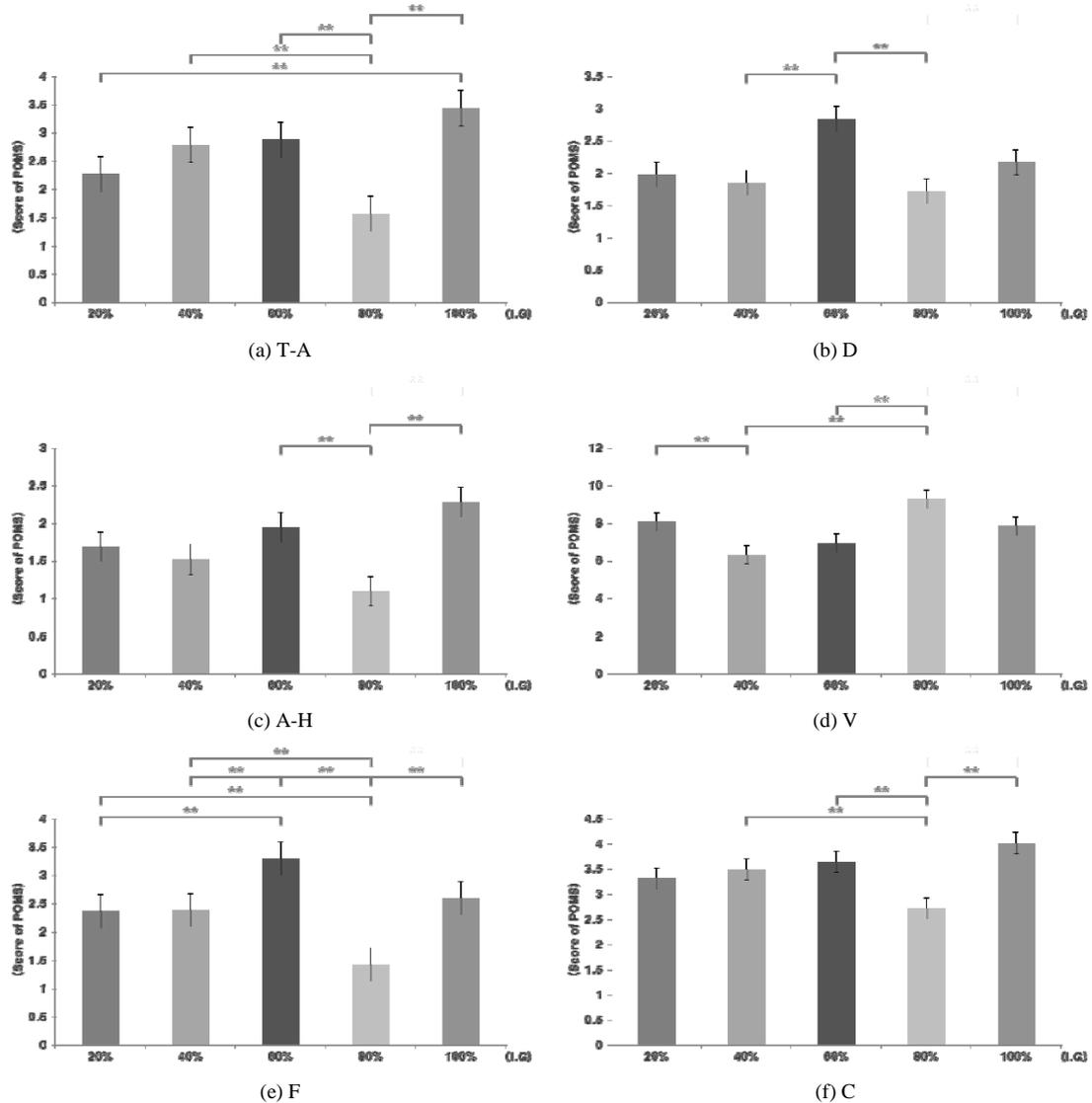


Fig. 2. Change of POMS result of male according to index of greenness((a) Tension and Anxiety, (b) Deperesstion, (c) Anger and Hostility, (d) Vigor, (e) Fatigue, (f) Confusion).

lowest tension-anxiety as 1.57 point, and green area ratio 100% shows the highest tension-anxiety as 3.44 point. And As green area ratio 40%, 60%, 100% showed higher tension-anxiety record than average, the higher green area ratio doesn't release tension-anxiety. As a result of statistic analysis, green area ratio 20% and 100%, 40% and 80%, 60% and 80%, 80% and 100% revealed statistic similarity.

In the case of D item, green area ratio 80% feel the lowest depression as 1.72 point, and green area ratio 60% shows the highest anxiety differently with T-A. Total average D point is 2.11 and the depression emotion at green area ratio 20%, 40% and 80% has relatively low depression than 60% and 100%. As a result of statistic analysis of D point in low rank, green area ratio 40% and 60%, 60% and 80% revealed the statistic similarity. This shows that green area ratio 60% feels more depression than green area ratio 40%, and green area ratio 80% feels less depression than green area ratio 60%.

And in the case of A-H item showing negative emotion, with the same as prior mentioned A-H, green ratio 80% shows the lowest with 1.1 point, and green ratio 100% shows the highest with 2.28 point, and statistic similarity revealed in green area ratio 60% and 80%, 80% and 100%, and it doesn't show statistic similarity but male students among testees show higher anger as green area ratio 60%(1.95 point), 100%(2.28 point) than lower green area ratio 20%(1.69 point), 40%(1.52 point).

In the case of vitality(V) as one of the critical and important item to determine the value of total TMD, green area ratio 20% shows 8.07 point, 40% shows 6.33 point, 60% shows 6.94 point, 80% shows 9.28 point, 100% shows 7.85 point. Green area ratio 20% and 40%, 40% and 80%, 60% and 80% proved statistic similarity, 20% and 80% than green area ratio 40% feels higher vitality, 80% than 60% feels high vitality.

Psychological fatigue and depression shows

similar tendency and each 20% shows 2.37 point, 40% shows 2.39 point, 60% shows 3.3 point, 80% shows 1.43 point, and 2.6 point, therefore revealed as $60% > 100% > 40% > 20% > 80%$ in order.

While statistic similarity was verified according to the difference of green area ratio differently with depression(D) item, green area ratio 20% verified similarity at 60% and 80%, 40% shows similarity with 60% and 80%, 60% was similar with 80%, 80% was similar with 100%. This revealed the difference between psychological fatigue according to the green area ratio.

Finally, in the case of confusion(C), green area ratio $100%(4.02 \text{ point}) > 60%(3.65 \text{ point}) > 40%(3.5 \text{ point}) > 20%(3.31 \text{ point}) > 80%(2.72 \text{ point})$ in order with the same as fatigue(F) item. As a result of statistic analysis, statistic similarity difference was analyzed as 40% and 80%, 60% and 80%, 80% and 100%.

As a result of low rank 6 times of POMS, verified similarity of green area ratio in all items is 60% and 80%, mood condition of male students at green area ratio 80% is good than green area ratio 60%, is verified statistically.

3.1.2 POMS result of female students

T-A item at POMS of female students shows 1.83 points at green area ratio 80%, 20% shows 2.51 point, 100% shows 3.24 point, 40% shows 3.55 point, 60% shows 4.11 point, green area ratio 80% with the male student equally shows the lowest, the highest tension-anxiety was revealed at green area ratio 60%. As a result of statistic analysis, green area ratio 20% and 60%, 40% and 80% shows statistic similarity, and similarity difference of green area ratio 20% and 100%, 60% and 80%, 80% and 100% wasn't analyzed.

In the case of depression(D), green area ratio was investigated as $60%(3.62 \text{ point}) > 100%(2.51 \text{ point}) > 20%(2.32 \text{ point}) > 40%(2.27 \text{ point}) > 80%(1.62$

point) in order, green area ratio 60% and 100% feels relatively depression than green area ratio 20%, 40%, 80% as total average 2.46 point, it showed as the same analysis result with depression item. As a result of statistic analysis, green area ratio 20% and 60%, 40% and 60% shows statistic similarity.

Anger(A-H) item score of female student is the

lowest as 1.62 point at green area ratio 80%, and the is the highest 3.04 point at green area ratio 60%, and revealed as the same result with tension-anxiety(T-A) item. while, anger of male students(A-H) item shows green area ratio 100% shows the next highest score 2.28 at green area ratio 60%. Anger(A-H) item revealed as 60% > 100% > 40% > 20% > 80% in

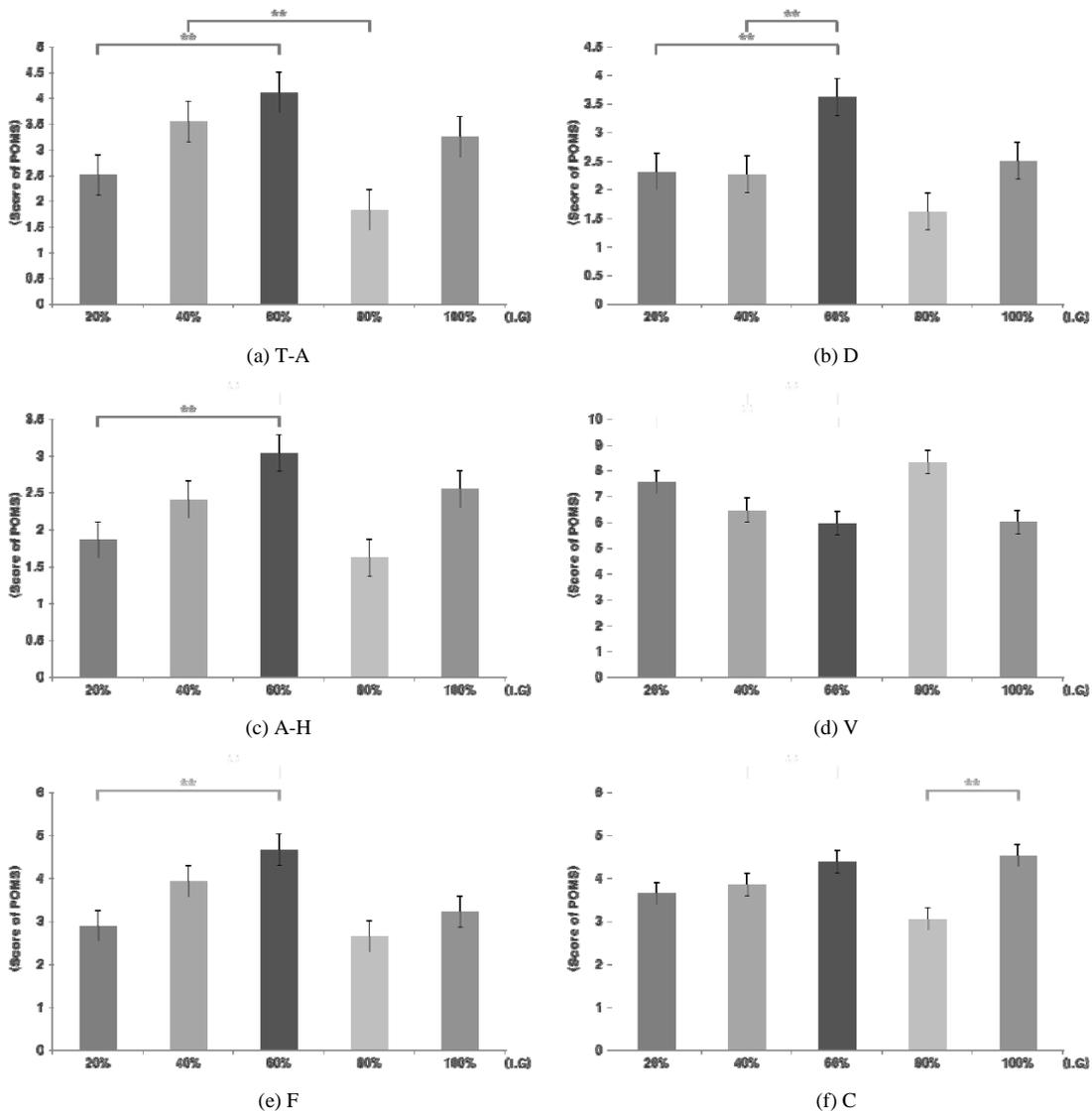


Fig. 3. Change of POMS result of female according to index of greenness((a) Tension and Anxiety, (b) Depression, (c) Anger and Hostility, (d) Vigor, (e) Fatigue, (f) Confusion).

order, green area ratio 20% and 60% only were analyzed of statistic similarity.

As a result of score vitality(V), green area ratio 80%(8.34 point) > 20%(7.55 point) > 40%(6.48 point) > 100%(6.02 point) > 60%(5.97 point) was showed in order, while green area ratio 80% shows the highest score with male students equally, unlike the male students with the lowest at green area ratio 40%, vitality shows the lowest at green area ratio 80%. And as a result of statistic analysis, any green area ratio doesn't show statistic similarity compared with male students showing green area ratio 20% and 40%, 40% and 80%, 60% and 80%.

As a result of POMS statistic analysis of male students, in the case of fatigue(F) showing statistic similarity the most, female student appeared as 60%(4.67 point) > 40%(3.93 point) > 100%(3.23 point) > 20%(2.9 point) > 80%(2.65 point) in order, and in the case of confusion(C) revealed as 100%(4.53 point) > 60%(4.39 point) > 40%(3.86 point) > 20%(3.65 point) > 80%(3.06 point) in order. As a result of statistic analysis, fatigue(F) item shows the statistic similarity at green area ratio 20% and 60%, confusion(C) item shows the statistic similarity at green area ratio 80% and 100% each.

3.1.3. Result of total TMD analysis

As a result of analyzing total TMD of male and

female students, both male and female students revealed as 60% > 100% > 40% > 20% > 80% in order, green area ratio 60% recorded the highest, therefore mood condition shows the lowest, green area ratio 80% recorded the lowest was analyzed as the best mood condition. As a result of statistic analysis, in the case of male students, green area ratio 20% and 40%, 20% and 60%, 20% and 100%, 40% and 80%, 60% and 80%, 80% and 100% showed statistic similarity, in the case of female student, green area ratio 40% and 60% only showed the statistic similarity.

As a result of total TMD analysis, total TMD score of female students was formed higher than male students, and it means female has twice higher risk of depression and anxiety symptoms than male, and female connected with emotion increases the activation of brain area, and it was the same research result that reaction of stress was faster than male. And as reason of showing the best mood condition at green area ratio 80%, visual effect was big by three-dimensional artwork for beauty and order and unification of greens and henceforth periphery building and sculpture when doing scenic planting need to be considered with the balance of greens.

3.2. Result of SD analysis

As a result of SD analysis of male students, green

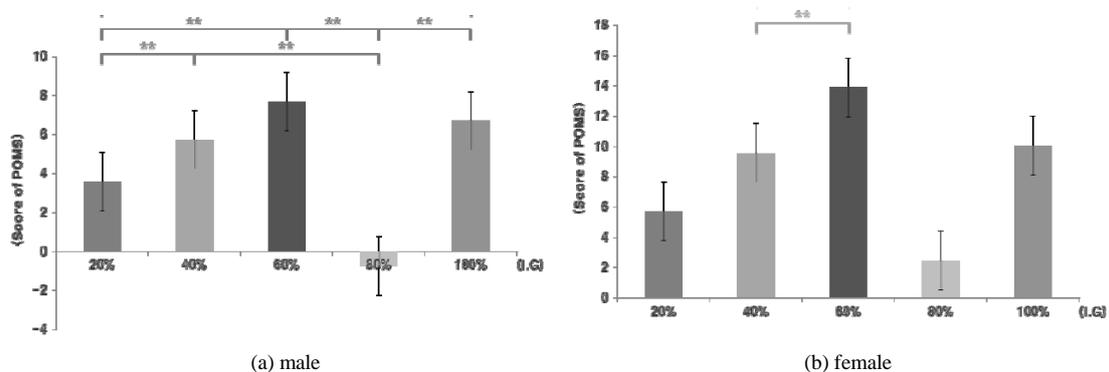


Fig. 4. Result of TMD according to index of greenness.

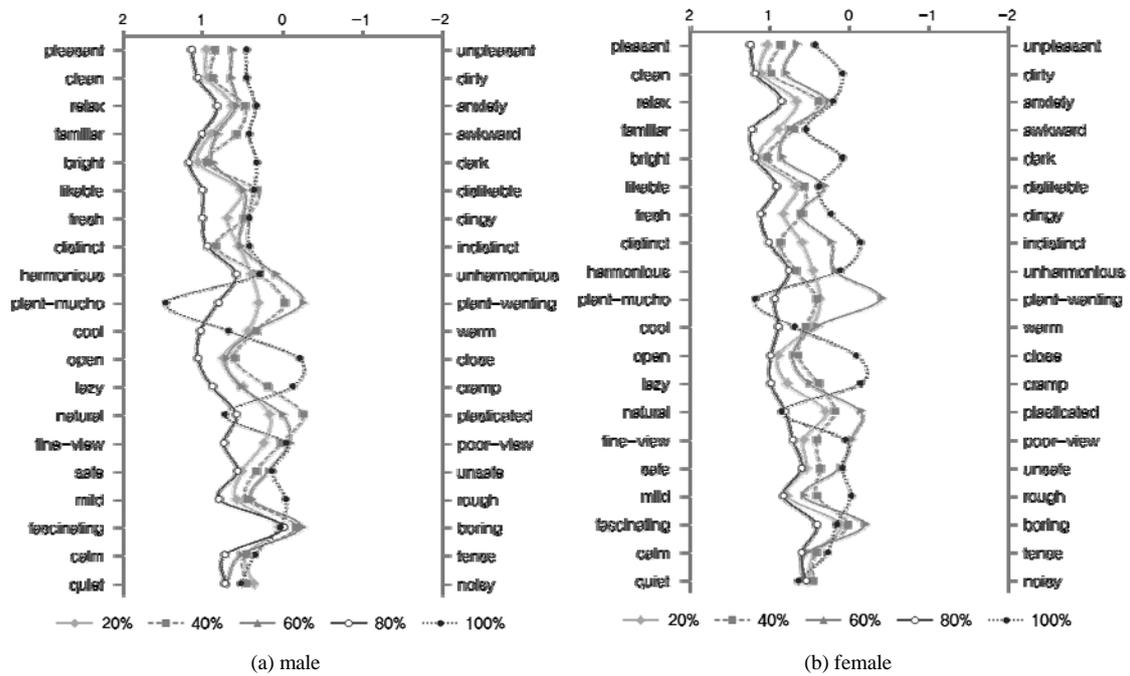


Fig. 5. Result of SD according to index of greenness.

area ratio 20% shows 0.54 point, 40% shows 0.4 point, 60% shows 0.39 point, 80% shows 0.83 point, 100% shows 0.34 point, green area ratio shows 80% > 20% > 40% > 60% > 100% in order, and green area ratio 80% shows the highest equally with POMS, the lowest score was analyzed as green area ratio 100%. As a result of comparing the green area ratio 80% and 100%, 0.49 point showed in difference, the rest of the 17 items received the high score than green area ratio 100% except 3 items, fluent, natural and funny plants etc.

In the case of female, green area ratio was shown as 80% > 20% > 40% > 60% > 100% in order, and was investigated as 0.89 point, 0.66 point, 0.37 point, and 0.28 point each. Green area ratio 80% and 100% was shown in difference as 0.61 point, therefore the difference with male was more obvious. In addition, fluent, natural plants like male are evaluated at green area ratio 100% than green area ratio 80%, except for

this, the rest items showed the high score at green area ratio 80%.

In conclusion, as a result of SD from testees, green area ratio 80% received the highest evaluation, and green area ratio 100 makes feel fluent and natural but closed and constrained than green area ratio 80%.

And, the higher green area ratio equally with POMS, the more feeling of positive mood condition is not, rather the balance with surrounding environment is important.

4. Conclusion

In this research, psychological condition was analyzed by testee according to green area ratio in space of scening planting using psychometric instrument, POMS and SD. In the case of POMS, total 6 items and all items were calculated having total TMD, and were investigated, in the case of SD, experiment having total 20 adjective items is

proceeded.

In the case of POMS between two psychometric instrument, as a result of total TMD, male and female students both were investigated as having the best feeling at green area ratio 80%, but having the worst feeling at 60%. And low rank item of POMS except total TMD equally showed the most positive feeling at green area ratio 80%, in the case of SD, as the same with POMS, the positive image feeling was given at 80%, the most negative green area ratio 100% gives closed and constrained feeling from testees.

As a result of synthesizing these data, psychology that human feels at green area ratio 80% is the best and henceforth it should offer not only securing proper green area ratio in planting space as scenic planting but also psychological comforts for users of scenic planting place through considering the balance of planting with surrounding environment, and it is judged to be achieved of planting plan considering ecological characteristic and green area ratio.

Acknowledgements

This work was supported by Konkuk University.

Reference

- Hartiga, T., Mang, M., Evans, G. W., 1991, Restorative effect of natural environment experiences, *Environment and Behavior*, 23(1), 3-26.
- Jo, Y. H., 2003, Promoting green streetscape in Seoul, J. Seoul Stud.
- Kaplan, R., Kaplan, S., 1989, *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press.
- Kim, H. J., 2005, Study of measuring visual quality of urban streetscape using ratio of greenery, Ph. D. Dissertation, Hanyang University.
- Kim, J. H., Yoon, Y. H., 2011, Economic analysis and energy reduction by the types of the green roof, J. Seoul Stud., 12(2), 124-140.
- Kim, J. H., Lee, S. Y., Yoon, Y. H., 2013, The effects of urban stream landscape on psychological relaxation of university students: focused on Chenggyecheon, Seoul, Korea, J. Seoul Stud., 14(1), 169-182.
- Lee, Y. J., 2004, A application study of envi-met model in urban management planning for the amenity of urban environment, Ph. D. Dissertation, Pusan National University.
- McNair, D. M., Lorr, M., 1965, An analysis of mood in neurotics, *J. Abnormal and Social Psychology*, 69, 620-627.
- McNair, D. M., Lorr, M., Droppelman, L. F., 1992, *Manual for the profile of mood states*, San Diego: Educational and Industrial Testing Service.
- Ulrich, R., 1991, Stress recovery during to nature and urban environments, *J. Environ. Psychol.*, 11, 201-203.
- Yi, Y. K., Yi, P. I., 2006, The impact of landscape type on urban office workers' stress and cognitive performance: comparison between natural and urban landscape, *J. Korean. Inst. Land. Arc*, 33(6), 1-11.
- Yoon, J. R., 1993, The effects of prolonged running to various exercise intensities on hormone responses and mood states, Ph. D. Dissertation, Seoul National University.