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The Effectiveness of Three Tier Combine Drainage System at the Wetland Soil of Western Georgia

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Abstract

The wetland zone of West Georgia with its natural-climate condition is difficult and peculiar reclamation object. Due to the peculiarity and diversity of causes of bogging, it is necessary to use all the methods that are known today in reclamation practice, and, in some cases, special measures are needed.

We have been processed combined three-step drainage system in order to regulate the water-air regime on the Colchis lowland wetland soils. Its scientific-technical novelty priority is certified by the patent certificate of Georgia, its main advantage, is the fastest surplus of water compared to the two step drainage implemented in the practice, which is very important in wetland regions as well as supporting the development of agriculture and infrastructure.

Keywords- Drainage, Combined, Three-tier, Wetland.

For Georgia, as small land country, mastering of soil resources and rational using represents especially importance issues. Because recently, in the ideology of mastering wetland region, moved on to the foreground problems of saving of existing ecosystem, using environmental and capital utilizing, topical problems of farmers' specifics. It has been in the agenda intensively treatment of Colchis lowland by using of modern scientific-technical progress achieves.

The study of wetland zone, industrial mastering and same time their protection, the problematic issues are included in the queue. It should be noted from the causes of bogging a large amount of atmospheric sediments characteristics for Western Georgia. The bogging affects not only the annual total of precipitation, but also the nature of their coming. Most of the precipitation comes from the seashore. The number of sediments in the east is gradually decreasing, while approaching the lower hills of the lowland again increase. In winter the rains come in the form of long rain and snow.

Table 1
Climate Change in Kolkheti Lowland Districts (by 2015)

District	Temperature, ∘C		Rainfall, mm		Wind speed, m /s
	Annual	In summer months	Annual	In summer months	
Zugdidi	13,4-14,5	22,5-23,5	1536-1783	479-553	2-4
Samtredia	13,4-14,5	21,7-22,4	1316-1535	346-381	2-4
Lanchkhuti	12,5-13,8	21,7-24,2	1536-1783	432-433	2-4
Abasha	13,4-14,2	22,5-23,5	1536-1783	382-431	2-4

The drainage constructions, as rule, are used to reduce the level of ground water and decrease their pressure. Drying of separate layers (dehydration) increases soil stability in the contact zone. The Protection of wetland areas does not mean the termination of development of economy in the region, on the contrary, technical progress should be developed in harmony with nature and based on the fundamental research results.

As a result of multi-year study, only closed drainage cannot provide a normal water-air regime for the plant on the heavy mechanical composition of the Colchis Lowland[1,2]. To improve the quality of such kind of soil it is necessary to develop a strengthening measure for surface water withdrawal.

We have been processed in order to regulate the water-air regime on the Colchis lowland wetland soils, combined three-step drainage system, which scientific-technical novelty priority is certified by the patent certificate of Georgia, its main advantage, compared to the two step drainage implemented in the practice, is the fastest surplus of water, which is very important in wetland regions as well as supporting the development of agriculture and infrastructure[3,5]. The combined drainage consists of underground scattered drains (1), under which water intake is placed - (2) pipes made of high strength polyethylene material elliptical perforated knots (4). The water intake is connected to the pipeline (3), which is installed in water pump collector [4]. (fig. 1,2).
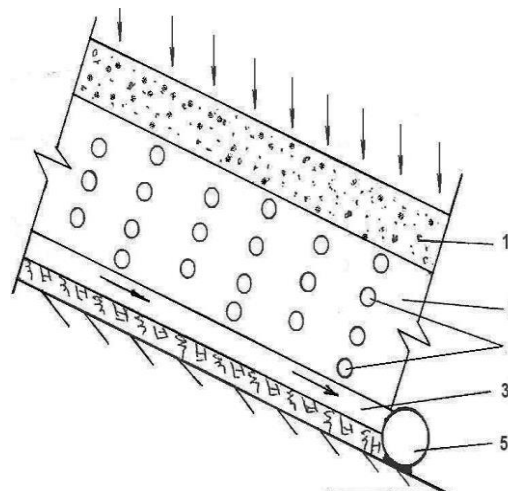
fig.1. Longitudinal Crossing of Combined Drainage
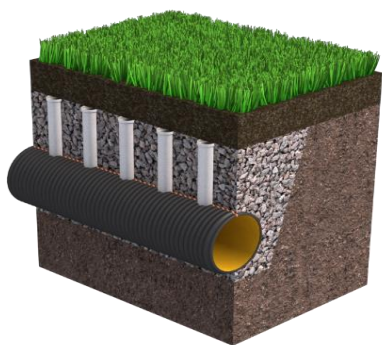
fig.2.The Model of Tree Tier Drainage System

The model of the three-tier combined drainage consists of: First tier - fractal drum (depth - 0,30 m), - surface runoff to regulate water; Second tier - perforated construction of vertical circuit polyethylene (diameter - 0.10 m) to remove groundwater (length - 0.40 m) and third tier - water pump - mixed / mixed collector - from surface and ground water source Diameter - 0,30 m). (See fig. 3).

fig.3. Field Model of Three-tier Combined Drainage

Prior to implementation of the drainage system, it was studied Granulometric composition of the soil-ground on the research objects in region Samtredia village Didi Jikhaishi. The quantity shown in Table 2, shows that the content of the physical clay is 37-63% in the upper layer thickness and 21-32% of the lamina That the study object is spread on clay, heavy loamy soils.

Table 2.
Granulometric Composition of the Soil-ground

Location	depth	factions size, mm						
		1-0.25	0.25-0.05	0.05-0.01	0.01-0.005	0.005-0.001	< 0.001	< 0.01
Samtredia-village Didi Jikhaishi. Clay, heavy loamy	0-15	0.4	11.1	25.7	12.8	20.8	29.2	62.8
	20-35	0.3	8.2	31.8	18.2	24.2	17.3	59.7
	40-50	0.7	9.5	28.9	9.8	15.9	35.2	60.9
	50-75	0.9	9.2	38.6	8.4	14.5	28.4	51.3
	75-100	0.6	11.7	50.5	5.5	10.5	21.2	37.2
	0-100	0.6	9.9	35.1	10.9	17.2	26.3	54.2

To fill three-tier drainage we used the village of Kvitiri. The inert jacket ballast from river Gubistskali career and found mechanical composition.

Under intensive rainfall, field surveys were observed on the ability of water-intensity combined drainage structures. In order to determine the efficiency of the field drainage construction we have observed on the site and we measured the water flow from the water source to seasonal rains (fig. 4).

fig.4. Determination of Water Expenditure 2015 November, village Didi Jikhaishi.

For the study of hydrological work efficiency of three-tier combined drainage mathematical calculations have been carried out with consideration of the precipitation received in the study area, the quantitative indicators are given in Table 3.

Table 3.
The Effectiveness of Hydrological Work Efficiency of Three-tier Combined Drainage

Date	Atmospheric sediments (mm / day)	Drainage runoff at the study area (0,0144 ha) L/s			L/s	Drainage runoff Module (l / s. ha)	Load drainage system, mm / day	Share of the rainfall, (%)
		I Miles	II Miles	Average				
03.04.15	24,0	2,0	1,2	1,60	0,027	1,88	16,2	67,5
04.04.15	15,6	0,9	0,5	0,70	0,012	0,83	7,2	46,2
24.12.15	8,2	0,4	0,2	0,30	0,005	0,35	3,0	36,6
20.01.16	16,2	1,0	0,6	0,80	0,013	0,90	7,8	48,1
24.01.16	12,4	0,6	0,5	0,55	0,009	0,62	5,4	43,5

As a result, calculating hydraulic efficiency of combined drainage and hydroelectric efficiency in the lowland calculation, we found that its average value switched from 36,6 to 67.5% (the number of rainfall), indicating the high efficiency of combined drainage.

Fig.5. The Polygon After and Before Drainage Systems 2015y.

As a result, estimated water permeability of new drainage system, which meaning is 2 times more compare to existing two-tier drainage system. In case of serial production, the drainage system its technological scheme envisages recycling of secondary raw materials, for example, the use of secondary polyethylene or plastic material, which will be a modest step in solving the global problem of utilization of polyethylene material.

With the theoretical calculations are very interesting to conduct a field survey in other regions of Western Georgia, (Anaklia, Poti) and to determine the efficacy of three-tier drainage, by taking in to account the annual number of precipitation received and the existing surface and ground water levels, which is the next stage of the study. The issue is particularly relevant to the construction of the Anaklia Deepwater Port and the development of nearby infrastructure. It will be estimated, possibility of drainage system use to avoid flooding of transport infrastructure, playing grounds, yards of cultural yards and its adjacent territory.

References:

1]. Guguchia M.The Study of Three Tier Drainage and Use If for Colchis Wetland Soils Reclamation XII International Conference of Environmental, biological and ecological sciences. Madrid. 2014.

[2]. Guguchia M. To Arrange of Field Testing Area for Research of Combined Three Tier Drainage. Ministry of Education and Science of Georgia Ts. Mirtskhulava Water Management Institute of Georgian Technical University. Collected Papers №69, Tbilisi 2014.pp.74-77

[3]. Gavardashvili G.,Guguchia M. Determining the Distance Between Drainage Canals of Three-Stage Combined Drainage Systems. Hydroengineering. Georgian Technical University-Tbilisi 2016.pp. 29-35

[4]. Gavardashvili G.,Guguchia M. The Research of the Combine Three Tier Drainage. International scientific-practical conference use of reclamed land Current State and prospects of Development reclamative farming. Russia-Tver . 2015.

[5]. Guguchia M. The Determination of Hydrological conditions of modern combine Drainage Construction. 6-th International Scientific and Technical Conference "Modern Problems of Water Management, Environmental Protection, Architecture and Construction.Tbilisi 2016.

Effect of Magnetic Field on Germination, Morphologic and Physiologic Characters of English Marigold (*Calendula officinalis* L.) at Salinity Concentrations

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Abstract—The use of magnetic field as a pre-sowing treatment has been adopted by researchers as a new environmental friendly technique and an effective method to increase sustainability in agriculture especially in saline soils. The aim of this study was to investigate the effect of salinity levels (0, 75 and 150 mM) and the duration of treatment of seeds with magnetism (non-treatment of seeds with magnetism, treatment of seeds with magnetic intensity of 20 µT for 5, 10, 15 min) on germination and growth of seedlings in English marigold. This study was conducted under laboratory conditions in three replications in a factorial arrangement based on a completely randomized design in Depako Tabriz Water and soil Lab. in most traits, the interaction of salinity levels and treatment duration with magnetism were significant. In the absence of magnetic treatment, salinity of 75 mM significantly reduced the seedling length (43.5%), seedling dry weight (28.3%), seedling dry weight (30.4%) and germination percentage (59.1%). salinity of 150 mM, inhibited germination and seedling growth of English marigold, while the magnetic treatment improved germination and seedlings growth under salinity conditions. Based on these results, magnetic treatment reduced the negative effect of salinity on germination and seedling growth. However, in most of the traits, the magnetic treatment of seeds did not have a significant effect on zero salinity. It seems that the magnetic treatment of seeds with an effect on alpha-amylase activity improves the transfer of seed reservoirs and improve seedlings growth in the marigold at salinity conditions. Both salinity treatments and magnetic treatment of seeds have a significant effect on alpha amylase activity. In general, the magnetic treatment of seeds for 15 minutes was the best treatment to improve germination and seedling growth of English marigold in non stress conditions and salinity.

Keywords—English marigold, Germination, Magnetism, Salinity.

I. INTRODUCTION

To increase agricultural sustainability, it is necessary to find environmentally-friendly technologies to increase seedling vigour, crop establishment and crop production. Safe methods for increasing yield include the minimal use of chemicals and/or substitution of chemicals with appropriate physical treatment. Using magnetic fields as a physical treatment to increase seed germination and emergence is a safe and practicable method in crop production systems and importantly, leaves no environmental residue. Magnetic field treatment can change the course of some processes in the seeds and thus stimulate plant development, germination and growth [1].

Salty soils in Iran contain about 23.8 million hectares of total land [2]. Phenomena such as low rainfall, high surface evapotranspiration, saltwater irrigation, mineralization, and poor agricultural practices have increased salinity levels by up to 10% per year. Salinity can be defined as the electrical conductivity above 4 dS / m of saturated extract in the root zone development at 25 ° C and 15% exchangeable sodium [3]. Increasing salinity affects seed germination with toxic effects of ions such as sodium, chlorine, sulfate or osmotic stress [4]. Salinity affects all stages of plant growth, but seedling stage is the most sensitive stage in the growth of plants to salinity [5].

The results of the studies show that the electromagnetic field increases seed germination and seedling growth, increases chlorophyll content and increases yields in cereals, legumes, vegetables and fruits [6]. Magnetic fields affect both the activity of ions and the polarization of bipolar molecules in living cells [7]. The effect of the electromagnetic field on the germination and seedling growth depends on the severity and duration of the placement and the type of seeds [8]. Moghimi and Ghavami [9] observed a decrease in growth and chlorophyll content in the english marigold plant under the influence of salinity. Nofal et al. [10] reported a decrease in leaf area, number of leaves, plant height, number of branches, dry shoot weight, flower number, and spring weight under salinity. Şen and Alikamanoğlu [11] observed that seed treatment of this plant with magnetic field improved germination, root and stem growth, root and stem fresh weight Wheat in salinity without stress and stress condition. Karimi et al. [12] also showed that the magnetic field treatment of wheat seeds improved germination, fresh and dry weight of root and stem, seedling dry weight, root length and stem, and proline content of corn seedlings In normal conditions and salinity. Ülgen et al. [13] showed that germination indices of Melissa officinalis seeds decrease with increasing magnetite treatment time.

Calendula officinalis L. (English marigold, pot marigold) belongs to the Asteraceae (Compositae) family; is a herbaceous plant, native of Mediterranean countries [14]. This plant is an annual plant with yellow to orange flowers and includes a high number of carotenoids such as flavoxanthin, lutein, rubixanthin, b-carotene, g-carotene, and lycopene. Calendula Officinalis is widely used in traditional medicine as an antiinflammatory agent and has also been reported to have anti-bacterial, anti-fungal and anti-viral activities [15]- [16]. According to the above, the aim of this study was to investigate the effect of salinity levels and duration of treatment with magnetism on germination and growth of Marigold seedlings.

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II. PROCEDURE FOR PAPER SUBMISSION

A. Review Stage

This experiment was conducted in 2017 in Tabriz Depako Water and soil Lab. This experiment was conducted as a factorial in a completely randomized design with three replications. The first factor was the treatment of seeds of English marigold with a magnetic field of 20 milliseconds intensity in four treatment times (0, 5, 10 and 15 minutes) and different levels of sodium chloride at three levels (0, 75, 150 mM). A permanent magnet was used to apply the magnetic treatment of the seeds. To determine the exact intensity of the magnetic field tested, the magnetic field meter or Tesla meter (Figure 2.1) was prepared. At a certain distance from the magnet with a magnetic field intensity of 20 milliseconds, the seeds were placed. Before applying the magnetic treatment, the seeds were first disinfected with sodium hypochlorite (11%) for three minutes and then distilled water to remove the remaining sodium hypochlorite from the seed surface for several times. sodium chloride molecular weights (58.44 g / mol) was used to prepare saline solutions.

B. Lab procedures

In laboratory studies, an intravenous petri dish was dispensed with two layers of filter paper at the bottom of the Petri dishes. Then, 40 seeds of marigold were put in each petridish and a layer of filter paper placed on them. Germination experiments were carried out at 20 ° C for 11 days. At the end, the number of germinated seeds was counted and the length of the roots and shoots was measured. The seedlings grown in each petri dish were separated from the remaining seeds and placed inside the laboratory envelope, and then were placed into an oven unit that had been set at 80 ° C for 24 hours, then after 24 hours seedlings, The envelope was removed and weighted by a scale of 0.001 g.

C. Extraction and assay of α-amylase

Xiao [17] method was used to measure the activity of α-amylase enzyme. Color absorption was measured using a spectrophotometer at a wavelength of 620 nm and compared with control.

D. Traits measurements

Uniformity of germination U7525was based on the Hill function reported by Joosen et al [18] U7525 is the time from T25to T75or T75–T25(h), while T25is time to reach 25% germination, and T75is time to reach 75% germination.

The tissue water content (TWC) was calculated based on equation (1) (Black and Pritchard, 2002).

$$TWC = \frac{Fresh\ weight - Dry\ weight}{Fresh\ weight} \times 100 \qquad (1)$$

Analysis of variance of studied traits was performed using SAS software. The comparison of the mean of data was also done using the same software using Duncan's test and drawing charts using Excel software.

III. RESULTS AND DISCUSSION

In this study, the main and mutual effects of salinity and seed magnetic treatment duration were significant on germination percentage of seedlings of English marigold (Table 1).

Table 1: Analysis of variance of studied traits in English marigold

Source of variations	df	Germination percentage	Seedling length	Seedling fresh weight	Seedling dry weight	Vigor index	Alpha amylase activity	Germination uniformity	Rate of transmitted seed reservoirs	Rate of water absorbance	Tissue water content	Seedling vigor index	percent of transmitted seed reservoirs
Magnetic treatment	3	616.93*	6.56**	0.048**	0.0014**	17.078**	9.214**	0.011**	0.003	15018.0**	1853.091**	17.078**	0.055
Salinity level	2	10875.5**	77.32**	1.002**	0.0259**	451.561**	31.470**	0.002	0.005*	268005.8**	1855.430**	451.561**	0.108*
Magnetic and salinity	5	498.8	2.3*	0.023**	0.0006**	8.492**	7.906**	0.010**	0.003	12118.5**	1710.864**	8.492**	0.054
error	22	164.9	0.604	0.0049	0.0001	1.644	0.124	0.001	0.002	1018.2	4.216	1.644	0.031
C.V (%)	33	20.7	13.809	10.944	11.7	18.91	5.78	17.41	40.61	10.19	2.66	18.91	40.65

In this study, the highest seed germination percentages of 100% in English marigold observed in two treatments for non-application of saline and magnetic treatments and 15 minutes treatment with magnetism at zero salinity levels. The lowest germination percentage of Marigold seeds was obtained in treatment of zero magnetic treatment in salinity of 150 mM. In this treatment, seeds did not sprout. After this treatment, the lowest seed germination percentage of Marigold seeds belonged to 5 minutes seed treatment with magnetism and salinity of 150 mM. In this study, salinity caused a significant decrease in seed germination percentages of English marigold. So that in the absence of application of magnetic treatment of Marigold seeds, salinity of 75 mM reduced 59.1% in germination percentages of English marigold (Table 2). Salinity is one of the most important stressors affecting seed germination of plants. Studies have shown that salinity through two mechanisms affects the percentage of germination of seeds. These mechanisms are the reduction of water absorption and the toxic effects of ions on the vital processes of seeds [19]. The lack of germination of seeds in saline soils is often due to the presence of salts around the seeds and the reduction of water absorption and ion toxicity. The salts reduce the structural and protein synthesis in the germinating embryo. Salinity disrupts hormonal balance and reduces the use of seed reserves [20].

Table 2: mean comparition of traits in marigold under salinity and magnetic treatment effect

Duration of magnetic treatment (minute)	Salinity level (mM)	Germination percentage	Seedling length (cm)	Seedling fresh weight (mg)	Seedling dry weight (mg)	Vigor index	Alpha amylase activity (U/g FW)	Germination uniformity (time interval between 75 and 25% of viable seeds to germinate (U7525), h)	Rate of water absorbance	Seedling Tissue water content	Seedling vigor index
0	0	100.00a	8.5000ab	0.86333ab	0.143333b	14.29 b	7.313 a	0.1780 ab	434.7 a	83.11 ab	14.29 b
0	75	40.83de	4.8000c	0.61867c	0.099667ed	4.043 ef	6.595 bc	0.1670 b	340.9 c	83.85 ab	4.043 ef
0	150	0 g	0 e	0 g	0 i	0.0000 g	0.0000 f	0.0000 c	0.0000 f	0.0000 c	0.0000 g
5	0	81.67ab	7.4333b	0.87567ab	0.140333b	11.38 c	7.126 ab	0.1780 ab	428.2 a	83.97 ab	11.38 c
5	75	63.33bcd	5.2000c	0.62100c	0.092000e	5.826 de	6.363 c	0.1780 ab	352.0 c	85.09 ab	5.826 de
5	150	8.33f	0.7000e	0.09267f	0.015333h	0.1290 g	5.225 e	0.2333 a	136.5 e	83.38 ab	0.1290 g
10	0	86.67ab	7.5667ab	0.84533ab	0.127333bc	10.91 c	7.360 a	0.1670 b	417.9 ab	84.88 ab	10.91 c
10	75	65.83bc	6.0000c	0.82400ab	0.116667cd	7.472 d	7.044 ab	0.1780 ab	433.5 a	85.80 a	7.472 d
10	150	25.00ef	2.2000d	0.23900e	0.037000g	0.9027 g	5.624 de	0.1890 ab	186.0 e	84.54 ab	0.9027 g
15	0	100.00a	8.9333a	0.90767a	0.164667a	16.51 a	7.204 ab	0.1670 b	412.3 ab	81.69 b	16.51 a
15	75	63.33bcd	6.0000c	0.75667b	0.104333ed	6.637 d	7.224 ab	0.1670 b	367.1 bc	86.18 a	6.637 d
15	150	47.50cde	4.6000c	0.42400d	0.069333f	3.285 f	6.152 cd	0.1780 ab	250.0 d	83.44 ab	3.285 f

Data with the same letters are not significantly different (P≤0.05)

In this study, in the zero salinity, magnetic seed treatment did not have significant effect on seed germination percentage of English marigold, but in both salinity levels of 75 and 150 mM, all of the periods of magnetic treatment of Marigold seeds, increased significantly Seed germination percentage. A higher increase in germination percentage of seeds of Marigold observed with increasing duration of magnetic treatment of seeds. Karimi et al. [12] also showed that the magnetic treatment of wheat seeds improves germination of corn seeds under normal conditions and salinity.

Figure 1: germination marigold seeds under salinity, zero, 75 and 150 mM salinity, left to right respectively

The results of analysis of variance of studied traits showed that interactions between salinity levels and duration of magnetic treatment of seedlings in Marigold had a significant effect on seedling length (Table 1). In this study, the maximum length of seedlings (8.9 cm) belonged to zero salinity and the duration of 15 minutes magnetic treatment of seeds. The salinity in this study caused a significant decrease in English marigold seedlings growth. So that the 75 mM salinity treatments in the absence of magnetic treatment reduced Marigold seedling growth by 43.5%. The decrease of seedling length under the influence of salinity was also observed in case of magnetic treatment of seeds. But with the excitement of the magnetic field, the effect of salinity on the length of the Marigold seedlings was lower. So, in the magnetic treatment of seeds for 5 minutes, seedling length decreased by 90.5% in the effect of salinity of 150 mM, while in the magnetic field treatment for 15 minutes seedlings length decreased by 48.3% under 150 mM salinity effect, which shows that the magnetic treatment of seeds can modify the effect of salinity on the length of the Marigold seedlings (Table 2). Similar studies in this regard also show the positive role of the magnetic field in reducing

the effect of salinity [21]. In a study on corn, Karimi et al. [12] observed that the application of a magnetic field reduced the amount of reduction in corn seedlings through salinity, which is in agreement with the findings of the present study. But in this study, in the conditions of salinity, the magnetic field did not have a significant effect on the length of the Marigold seedlings, similar results were observed in 75 mM salinity. But in 150 mM salinity, the application of magnetic treatment significantly affected the seedling length and higher time of magnetic field treatment, increased this trait more.

Figure2: growth of marigold seedling. 1-without salinity and magnetic treatment, 2- 75mM salinity, without magnetic treatment, 3- 150mM salinity and 15 minute magnetic treatment

Figure 3: growth of marigold seedling. 1- without magnetic treatment, 2- 15 minute magnetic treatment

Figure 4: growth of marigold seedling. 1-without salinity and magnetic treatment, 2- 150mM salinity and 15 minute magnetic treatment

In this study, the fresh and dry weights of Marigold seedlings were obtained in non-applied salinity treatments and the duration of the treatment was 15 minutes (0.9 g). The lowest fresh and dry weights of Marigold seedlings were also observed in 5 minutes treatment with field Magnetic salt was obtained at 150 mM. In this study, under non-magnetic treatments of Marigold, salinity of 75 mM decreased 30.4% and 28.3% in the fresh and dry weights of Marigold seedlings (Table 2). Lacramioara et al. [22] also observed a decrease in the growth of Marigold seedlings under salinity. Kochak-Zadeh et al. [23] pointed out the effect of reduction of salinity on the dry weight of plant seedlings, and menthioned that disruption of seed lipids

decomposition and reduction of sugars in the supply of embryonic energy is one of the most important reasons for dry weight loss of seedlings.

By applying magnetic treatment of seeds of English marigold, salinity also caused a significant decrease in seedling fresh and dry weight, but the decrease in fresh and dry fresh weight of seedlings was affected by salinity by increasing the treatment time of seeds with magnetism. The results of this study indicate that the magnetic treatment of seeds, increased seedling resistance under salinity in terms of seedling fresh weight. Various mechanisms for this magnetic effect have been reported. As Gao et al. [24] stated that salinity increased resistance to stressors, including salinity, by improving antioxidant capacity and improving the integrity of the plasma membrane.

In this study, Vigor index was the highest for 15 minutes treatment with magnetism and zero salinity. Salinity in the absence of magnetic treatment had the greatest impact on the Vigor index, so that 150 mM salinity completely prevented the germination of ever-spring seeds. However, the magnetic treatment of seeds increased not only in the non-salinity conditions of the Vigor index, but also in the salinity conditions. Seedling vigor index was similarly affected by salinity levels and magnetic treatment of seeds. The highest seedling vigor index was obtained for 15 minutes treatment with magnetism and salinity of zero. At all levels of magnetic treatment, seedling vigor index decreased with increasing salinity levels. Magnetic treatment of seeds at all levels of salinity caused a significant increase in seedling vigor index. Studies by Verma et al. [25] also showed that wheat seed vigor index and Vigor index increased by magnetic treatments. Aqa Mir et al. [26] also observed increase of the seedling vigor index of bean seedlings by the magnetic treatment of seeds affected by salinity. Zaidali et al. [27] considered the improvement of seed vigor index in wheat and wild rye under the influence of magnetic treatment of seeds caused by increased alpha amylase activity. While Ada et al. [28] showed that alpha-amylase activity was significantly reduced under the influence of salinity. In this study, both salinity treatments and magnetic treatment of seeds had a significant effect on alpha amylase activity. In the absence of magnetic treatment of seeds, salinity of 150 mM total prevented alpha-amylase activity and thus reduced germination and seedling growth. In the absence of magnetic treatment of seeds, even salinity of 75 mM can be attributed to alpha-amylase activity (Table 4). Researchers have reported that salinity strongly affects the activity of alpha-amylase, which is due to reduced water absorption and toxic effects of chloride and sodium salts on the activity of enzymes [28]. Despite the significant effect of salinity on the activity of alpha-amylase in the spring, the results of this study showed that the magnetic treatment of seeds reduced the effect of salinity on alpha-amylase activity. So that in the case of magnetic treatment of Marigold seeds for 10 and 15 minutes, salinity of 75 mM did not affect alpha-amylase activity, and even in these two levels, the salinity treatment of 150 mM decreased Alpha Amylase activity only by 23.2 and 15.2%. Therefore, the results of this study showed that in the conditions of salinity, the magnetic treatment of seeds had a positive effect on alpha amylase activity. However, in

the absence of salinity, the magnetic treatment of seeds did not affect the activity of alpha amylase. Rochalska and Grubovskaya [29] showed that the magnetic treatment of wheat seeds increases alpha-amylase activity in salinity conditions. Because studies have shown that with the magnetic treatment of seeds, plant enzymes become more resistant to stressors. In this study, salinity in the absence of magnetic treatment of seeds reduced the uniformity of seed germination, while, when applied to the magnetic treatment of the seeds, salinity levels had no significant effect on uniformity in germination of the ever-spring seedlings. These results indicate that the magnetic treatment of seeds plays an important role in the uniformity of seed germination, especially in salinity conditions. Aladjadjiyan et al. [30] also showed that the magnetic treatment of corn seeds increases the uniformity of germination of seeds under salinity conditions.

According to the results of this study, the rate of water absorption and the water content of tissue of the seedling decreased under the influence of salinity and salinity intensification was more effective on this trait. In these three traits, salinity of 150 mM in the absence of magnetic treatment of Marigold seeds, caused a 100% reduction, while salinity of 75 mM reduced the rate of water absorption by 21.6%. But did not have a significant effect on the tissue water content of the seedlings. Salinity reduced the rate of water absorption at all levels of magnetic treatment of seeds, but with increasing the pre-treatment time with magnetism, the rate of decrease in water absorption rate was more affected by salinity. In 15-minute treatment, seeds with magnetism reduced the rate of water absorption by 39.3%. According to the results, the tissue water content of seedlings did not change significantly under the influence of salinity and magnetism (Table 4). According to the results of this study, the percentage of transfer of seed reserves was not affected by the magnetic treatment of the seeds, but salinity had a significant effect on this trait (Table 1). According to the results of salinity of 150 mM caused 33.3% reduction in the percentage of transfer of reserves in English marigold seeds (Table 3). Alpha-amylase activity breaks down the sugars in the seed, when released sugars are used to grow seedlings. But the results of this study showed that salinity reduced alpha-amylase activity and thereby reduced the amount of transmitted seed reservoirs. Sedghi et al. [31] also reported that salinity reduces the amount of seed transferred in *Silybum marianum*, the main reason for which was the decrease in alpha amylase activity, which was also observed in the present study.

Table 3: mean comparition of traits in marigold under salinity effect

Salinity level (mM)	percent of transmitted seed reservoirs
0	0.4856 a
75	0.4920 a
150	0.3244 b

Data with the same letters are not significantly different (P≤0.05)

IV. CONCLUSION

The magnetic treatment of seeds increased seed germination an seedling growth of English marigold specially in salinity condition. so seed magnetic treatment

can be an effective method in order to increase plant performance in field without using chemicals and increasing cultivation sustainability.

ACKNOWLEDGMENT

REFERENCES

[1] C.J. Sudsiri, J. Nattawat, P. Kongchana, and R.J. Ritchie, "Effect of magnetically treated water on germination and seedling growth of oil palm (*Elaeis guineensis*)" *Seed Sci. & Technol.*, 44: 1-14, 2016.

[2] F. Gholizadeh, A. Manzari-Tavakkoli, A. Pazoki, "Evaluation of salt tolerance on germination stage and morphological characteristics of some medicinal plants artichoke, flax, safflower and coneflower," *International Journal of Farming and Allied Sciences*. 5: 229-237, 2016.

[3] H. N. K. Naik, and V. R. Devaraj, "Effect of salinity stress on antioxidant defense system of niger (*Guizotia abyssinica* Cass.)" *American Journal of Plant Sciences*, 7: 980-990, 2016.

[4] M. El Harfi, H. Hanine, H. Rizki, H. Latrache and A. Nabloussi, "Effect of drought and salt stresses on germination and early seedling growth of different color-seeds of sesame (*Sesamum indicum* L.),"*International Journal of Agriculture & Biology*. 5: 54-61, 2016.

[5] J. M. Jesus, A. S. Danko, A. Fiúza. and M. Borges, "Phytoremediation of salt-affected soils: a review of processes, applicability, and the impact of climate change," *Environ Sci Pollut Res*. 22: 6511–6525, 2015.

[6] S. Pietruszewski, and K. Kania, "Effect of magnetic field on germination and yield of wheat," *International Agrophysics*. 24: 297-302, 2010.

[7] F. Dhawi, J.M. Al-Khayri, E. Hassan, "Static magnetic field influence on elements composition in date palm (*Phoenix dactylifera* L.)" *Research Journal of Agriculture Biological Sciences*. 5(2): 161-166, 2009.

[8] J. Podleoeny, L.E. Misiak, A. Podleoena, and S. Pietruszewski, "Concentration of free radicals in pea seeds after pre-sowing treatment with magnetic field," *International Agrophysics*. 19: 243-249, 2005.

[9] S.M. Moghimi, and S. H. Ghavami, "Effect of Zeolite and salinity on growth indices of marigold (*Calendula officinalis* L.)" *Science Journal* . 36: 54-67, 2015.

[10] F. H. Nofal, M. U. El-Segai and E. A. Seleem, "Response of *Calendula officinalis* L. plants to growth stimulants under salinity stress," *American-Eurasian J. Agric. & Environ. Sci*. 15 (9): 1767-1778, 2015.

[11] A. Şen, and S. Alikamanoğlu, "Interactive effect of static magnetic field and abiotic stressors on growth and biochemical parameters of germinating wheat cultivars," *IUFS J Biol*. 75(1): 19-38. 2016.

[12] S. Karimi, S. Eshghi, S. Karimi, S. Hasan-Nezhadian, "Inducing salt tolerance in sweet corn by magnetic priming," *Acta agriculturae Slovenica*, 109: 89 - 102. 2017, 2004.

[13] C. Ülgen, A. Birinci Yildirim, A. Uçar Türker, "Effect of magnetic field treatments on seed germination of *Melissa officinalis* L," *Int. J. Sec. Metabolite*. 4: 43-49, 2017.

[14] G. Rigane, S. Ben Younes, H. Ghazghazi, and R. Ben Salem, "Investigation into the biological activities and chemical composition of Calendula officinalis L. growing in Tunisia". International Food Research Journal 20(6): 3001-3007. 2013.

[15] A. Salehi Sardoei, "Vermicompost effects on the growth and flowering of marigold," *European Journal of Experimental Biology*, 4(1):651-655, 2014.

[16] S. Shahidi, M. Mahmoodi, N. Farahmandlou, "Antinociceptive properties of hydro-alcoholic extract of *Calendula Officinalis* in Rat," *Basic and Clinical NeuroScience*. 5: 145-157, 2012.

[17] Z. Xiao, R. Storms, A.Tsang, "A quantitative starch-iodine method for measuring alpha-amylase and glucoamylase activities" Analytical Biochemistry, 351:146-148. 2006.

[18] R. V. L. Joosen, J. Kodde, L. A. J. Willems, W. Ligterink, L. H. W. V. D. Plas, H. W. M. Hilhorst, "Germinator: A software package for high-throughput scoring and curve fitting of Arabidopsis seed germination," *The Plant Journal* , 62: 148–159, 2010.

[19] B. Bojović, G. Đelić, M. Topuzović, and M. Stanković, "Effects of nacl on seed germination in some species from families Brassicaceae and Solanaceae,," *Kragujevac J. Sci*. 32: 83-87, 2010.

[20] A. J. Begum, P. Selvaraju, and B. Venudevan, "Saline stress on seed germination. *Scientific Research and Essays*," 8(30): 1420-1423, 2013.

[21] A. Bagherifard, and A. Ghasemnezhad, "Effect of magnetic salinated water on some morphological and biochemical characteristics of artichoke (*Cynara scolymus* L.) Leaves," Journal of Medicinal Plants and By-products. 2: 161-170. 2014.

[22] O. Lacramioara, M. Nicusor Grigore, G. Vochita, "Impact of saline stress on growth and biochemical indices of *Calendula officinalis* seedlings," *Romanian Biotechnological Letters*. 20: 11007-11017, 2015.

[23] A. Kochak-Zadeh, S. Mousavi, and M. Eshraghi-Nejad, "The effect of salinity stress on germination and seedling growth of native and breeded varieties of wheat," *Journal of Novel Applied Sciences*. 2: 703-709, 2013.

[24] Y. Gao, Y. Sun, R. Zhang and G. Chu, "Effects of Magnetic Water Irrigation on the Growth, N Uptake and Antioxidant Enzyme Activities of Cotton Seedlings," *Journal of Agricultural Science and Technology* B. 7: 25-33, 2017.

[25] O. Verma, N. Joshi, S. T. Pandey, R. C. Srivastava, S. K. Guru, "Comparative study of hydropriming to static magnetic field on seedling vigour and enzyme activity in wheat seed," *Agricultural Research*. 6: 235-240, 2017.

[26] F. Aghamir, H. Bahrami, M. Jafar Malakouti, S. Eshghi, F. Sharifi, "Seed germination and seedling growth of bean (*Phaseolus vulgaris*) as influenced by magnetized saline water,," *Eurasian J Soil Sci*. 5 (1): 39 – 46, 2016.

[27] E. Zeidali, Z. Rostami, F. Darabi, E. Soheyli, G. Nabiyouni, R. Naseri, "Germination and growth of wheat and wild oat seedling as affected by different intensities and times of magnetic fields" *Biological, Environmental and Agricultural Sciences* 2: 86-100, 2017.

[28] A. Adda, Z. Regagba, A. Latigui and O. Merah, "Effect of salt stress on α-amylase activity, sugars mobilization and osmotic potential of phaseolus vulgaris l. seeds var. 'Cocorose' and 'Djadida' during germination," *Journal of Biological Sciences*. 14 (5): 370-375, 2014.

[29] M. Rochalska, and K. Grabowska, "Influence of magnetic fields on the activity of enzymes: α- and β-amylase and glutathione S-transferase (GST) in wheat plants," *Int. Agrophysics*. 21: 185-188, 2007.

[30] A. Aladjadjiyan, "Study of the influence of magnetic field on some biological characteristics of *Zea mais*," Central European Agriculture Journal. 27: 89-94, 2002.

[31] M. Sedghi, A. Nemati, B. Amanpour-Balaneji and A. Gholipouri, "Influence of different priming materials on germination and seedling establishment of milk thistle (*Silybum marianum*) under Salinity Stress," *World Applied Sciences Journal*. 11 (5): 604-609, 2010.

Pathomorphological Features of Lungs from Brown Hares Infected with Parasites

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*Abstract*790 lungs from brown hares (*Lepus europeus* L.) from different regions of Bulgaria were investigated during the period 2009-2017. The parasitological status and pathomorphological features in the lungs were recorded. The following parasite species were established: one nematode - *Protostrongylus tauricus* (7.59% prevalence), one tapeworm – larva of *Taenia pisiformis – Cysticercus pisiformis* (3.04% prevalence) and one arthropod – larva of *Linguatula serrata – Pentastomum dentatum* (0.89% prevalence). Macroscopic lesions in the lungs were different depending on the causative agents. The infections with *C. pisiformis* and *P. dentatum* were attended with small, mainly superficial changes in the lungs. Protostrongylid infections were connected with different in appearance and burden macroscopic changes. In 77.7%, they were nodular, and in the rest of cases, they diffuse. The consistency of the lesions was compact. In most of the cases, alterations were grey in colour, rarely were dark-red or marble-like. In 91.7% of these cases, they were spread on the apical parts of large lung lobes. In 36.7% middle parts of the large lung lobes, and, in 26.7% small lung lobes, were also affected. The small lung lobes were never independently infected.

Keywords—Cysticercus pisiformis, Lepus europeus, lung lesions, Pentastomum dentatum, Protostrongylus tauricus.

I. INTRODUCTION

BROWN hare (*Lepus europeus* L.) is one of the basic game species on the European continent. However, reduction in its population in whole Europe is lately observed. According to [1], this is caused by changed living conditions, quantitatively and qualitatively insufficient nutrition, using of herbicides as well as various infectious diseases including parasitoses. Lung parasitoses in hare have been connected with different negatives. Alzaga et al. [2] have established correlation between parasite intensity and escape capacity in Iberian hares. According to [3], parasitic infections of the lungs influence the health and decrease the body weight of hares in Austrian and Czech hunting grounds. Other authors [4] consider that lung parasitoses such as protostrongylidoses

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are among the most dangerous diseases in lagomorphs at all and can be reason that influences their numbers in certain conditions. It has been established that infection intensity with one of the lungworm species in hares *Protostrongylus tauricus* can reach to several thousand of specimens in one animal and can cause serious damages of the lungs such as atelectasis, emphysema and necrosis which lead to impaired respiratory function, loss of weight, decrease of mobility and death cases [5]. In connection with the above mentioned, the aim of the present work was set to investigate species composition of the parasites affecting lungs of the brown hare in Bulgaria and correlated pathological changes in the organs.

II. MATERIALS AND METHODS

During the period 2009-2017, 790 lungs from brown hares from different regions of Bulgaria were investigated. The materials were received mainly from planned hunting (according to the "Law for hunting and game conservation" from 2000) and in a small degree from found dead hares. The lungs were disjoined from the carcasses, deeply frozen and subsequently sent for necropsies in laboratory conditions. If pathomorphological changes on the lungs were present, they were described according to commonly used criteria: localization, consistency, colour, formation of nodules, availability of other lesions, dissemination [6].

The macroscopic lesions were subjectively categorized in four groups depending on their dissemination: light (if small, hardly visible changes were available mostly on the dorsal surfaces of the large lung lobes), mild (affected up to 1/6 of the lungs), heavy (affected from1/6 to 1/2 of the lungs) and very heavy (affected above 1/2 of the lungs).

After the describing of pathomorphological changes, the lungs were investigated by the method of the full helminthological necropsy. Aiming to find small parasites localized in the terminal lung parts (small bronchi, bronchioles and alveoli), the pieces of changed lung tissue were investigated by their compression after boiling in lactic acid [7]. The species of the established parasites was determined according to their morphometric characteristics.

III. RESULTS AND DISCUSSION

The following parasite species were established: one nematode - *Protostrongylus tauricus* (7.59% prevalence), one tapeworm – larva of *Taenia pisiformis – Cysticercus pisiformis* (3.04% prevalence) and one arthropod – larva of *Linguatula serrata – Pentastomum dentatum* (0.89% prevalence).

The macroscopic changes round the *P. dentatum* infection

were weakly marked. They were small, single, compact areas or vesicles, approximately as a lentil of size, localized on the surface and more rarely in the inside of large lung lobes and contented pentastomid larva (Fig. 1 (a)). In one case, a group of several free pentastomid larvae was observed hooked on the mucosa of one of the large bronchi.

Larval forms of *T. pisiformis* were situated under the lung pleura. They were elongated, transparent vesicles with a size about 1 cm, contented one scolex (Fig. 1 (b)). Infection intensity was varying – in some cases cysticerci were single, in other they were multitude, sometimes they were above 50 on the lungs (Figs. 1 (c) and (d)).

Fig. 1 Macroscopic view of lesions in parasitized lungs from brown hares: (a) Infection with *P. dentatum*; (b), (c), (d) Infections with *C. pisiformis*
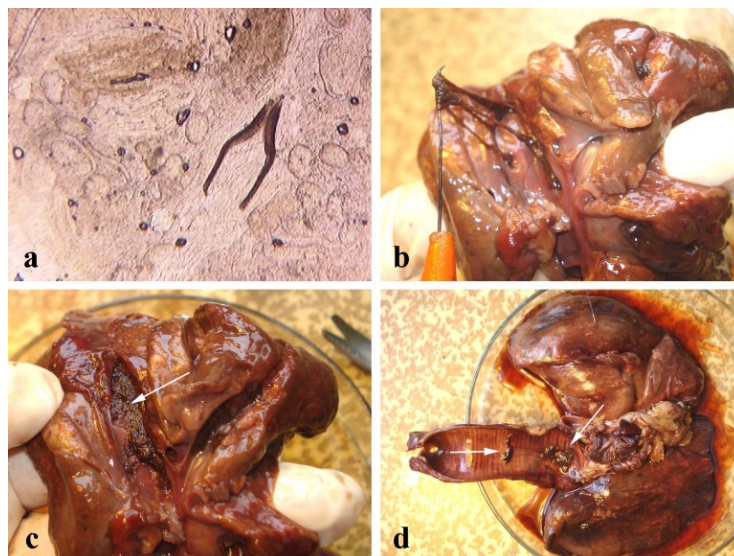
Fig. 2 Lungs from brown hares parasitized with *P. tauricus*: (a) View of spicules, eggs and larvae in changed lung tissue after boiling in lactic acid and compression; (b), (c), (d) Adult worms localized in middle, large bronchi and trachea

The lesions associated with *P. tauricus* were more varied and heavier. In all of the 60 cases of lungs with protostrongylids, parasites were localized in the terminal bronchi, bronchioles and alveoli and they were established only after observing under compression of changed lung tissue boiled in lactic acid (Fig. 2 (a)). In 50% of the cases, besides terminal lung parts, small bronchi were also affected. In 41.7%, lungworms were localized in terminal lung parts, small

and middle bronchi, in 16.7% parasites were also found in large bronchi and in 10% the whole bronchial tree, including trachea, was affected (Figs. 2 (b)-(d)).

The presence of protostrongylid infection in most of the cases was accompanied by pathomorphological lung changes. In 91.7% of the cases, they affected apical parts of the large lung lobes, in 36.7% - middle parts of the large lung lobes and in 26.7% small lung lobes were also affected (Fig. 3).

However, the small lung lobes were never independently infected. Similar alterations have been established by [8] in a mountain hare infected with *Protostrongylus pulmonalis*. Our findings correlate also with those by [9] where the majority and most severe histopathologic changes in mountain and brown hares infected with protostrongylids are located at the distal part of the caudal pulmonary lobes.

Fig. 3 Areas of pathomorphological changes in lungs from a brown hare infected with *P. tauricus*
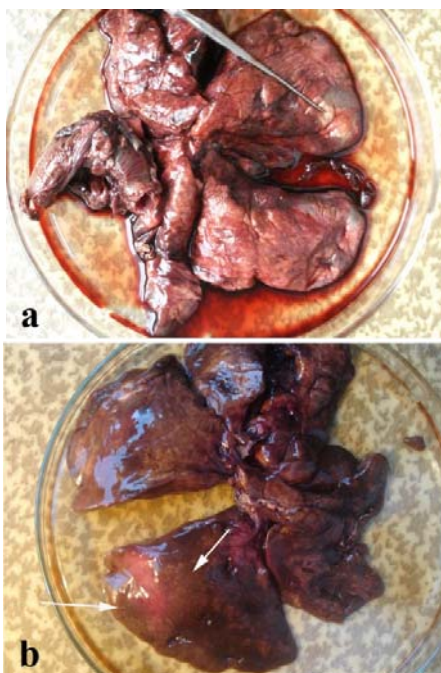
Fig. 4 Pathomorphological changes in lungs from brown hares parasitized with *P. tauricus*: (a) Grey coloured; (b) Brown coloured

In our study, the lesions associated with protostrongylids had compact consistency and varied in size, shape and colour. Most of them were nodular (77.7%) and the size of nodules was between pinhead and large almond. The size of the diffuse lesions was also different and sometimes affected large parts of the lungs. The last ones were observed mainly when the worms were localized in the large bronchi. This fact

associated with previous studies in ruminants when infections with big protostrongylids as *P. rufescens, P. hobmaieri* and *P. rupicaprae* were associated with extensive lesions located along the length of the large bronchi [10]. The alterations were coloured most often in different nuances of grey and brown (Fig. 4), more rarely they were dark-red to black or marble-like.

Fig. 5 Adult parasites (*P. tauricus*) from one brown hare: (a) Tangled and gathered as balls; (b), (c) A large quantity of worms found in bronchi and trachea

According to our criteria about subjective heaviness of the lung lesions, it was observed the following: in 71.67% of the cases they were light, in 15% - mild, in 11.67% - heavy and in 1.67% - very heavy. In most of the cases, correlation between the subjective heaviness of the macroscopic changes and infection intensity was observed. Usually, when the alterations were defined as heavy, bronchi were full and obturated by helminths. The parasites were tangled and gathered as balls,

they were hardly torn apart trying to divide and count them (Fig. 5 (a)). Protostrongylids collected from lungs with very heavy alterations of one animal are shown on Figs. 5 (b) and (c). Their quantity demonstrates the correlation between the subjective heaviness of macroscopic changes and infection intensity.

In conclusion, it can be stated that pathomorphological characteristics of the parasitized lungs of brown hares vary according to the species of the parasites which caused them, whereas the infections with *C. pisiformis* and *P. dentatum* lead mainly to superficial small changes in the lungs, protostrongylid infections are connected with different in appearance and burden lesions. The last ones most commonly have nodular character and affect apical parts of the large lung lobes. The study showed correlation between the subjective heaviness of the macroscopic changes in the parasitized lungs of brown hares and infection intensity.

REFERENCES

[1] T. Ilić, T. Petrović, and S. Dimitrijević, "Parasitic infections of wild rabbits and hares," *Vet. glasnik*, vol. 68, no. 3-4, pp. 241-250, 2014.

[2] V. Alzaga, J. Vicente, D. Villanua, P. Acevedo, F. Casas, and C. Gortazar**, "**Body condition and parasite intensity correlates with escape capacity in Iberian hares (*Lepus granatensis*)," *Behav. Ecol. Sociobiol.*, vol. 62, pp. 769, 2008.

[3] K. Chroust, M. Vodnansky, and J. Pikula, "Parasite load of European brown hares in Austria and the Czech Republic," *Vet. Med.*, vol. 57, no. 10, pp. 551–558, 2012.

[4] C. Lesage, D. Jouet, C. Patrelle, J. Guitton, A. Decors, and H. Ferte, "*Protostrongylus pulmonalis* (Frölich, 1802) and *P. oryctolagi* Baboš, 1955 (Nematoda: Protostrongylidae), parasites of the lungs of European hare (*Lepus europaeus* L.) in France: morphological and molecular approaches," *Parasitol. Res.*, vol. 113, no. 6, pp. 2103-2111, 2014.

[5] T. Genov, 1970, "A new and dangerous parasite in rabbits of this country," *Priroda, Sofia*, vol. 19, no. 4, pp. 65-68. (in Bulgarian).

[6] R. G. Thomson, M. D. McGavin, W. Carlton, and J. F. Zachary, *Thomson's Special Veterinary Pathology*, 3rd ed., M. D. McGavin, W. Carlton, and J. F. Zachary, Ed. Mosby, 755 pp., 2001.

[7] M. Panayotova-Pencheva, "Species composition and morphology of protostrongylids (Nematoda: Protostrongylidae) in ruminants from Bulgaria," *Parasitol. Res.*, vol. 109, no. 4, pp. 1015-1020, 2011.

[8] A. Battisti, M. Di Paolo, and G. Di Guardo, "Pulmonary protostrongyliasis in a Mountain hare from Italy," *J. Wildl. Dis.*, vol. 36, no. 2, pp. 367-369, 2000.

[9] J. Laakkonen, T. Nyyssonen, M. Hiltunen, K. Kauhala, S. Nikander, and T. Soveri, "Effects of *Protostrongylus* sp. and *Pneumocystis* sp. on the pulmonary tissue and the condition of mountain and brown hares from Finland," *J. Wildl. Dis.*, vol. 42, no. 4, pp. 780–787, 2006.

[10] M. Panayotova-Pencheva, and M. Alexandrov, "Some pathological features of lungs from domestic and wild ruminants with single and mixed protostrongylid infections," *Vet. Med. Intern.*, vol. 2010, Article ID 741062, 9 pages, 2010.

Effects of Storage Methods on Proximate Compositions of African Yam Bean (*Sphenostylis stenocarpa*) Seeds

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Abstract—One of the limitations of African yam bean (*Sphenostylis sternocarpa*) is poor storage ability due to the adverse effect of seed-borne fungi. This study was conducted to examine the effects of storage methods on nutritive composition of AYB seeds stored in three types of storage materials viz; Jute bags, Polypropylene bags and Plastic bowls. Freshly harvested seeds of AYB seeds were stored in all the storage materials for 6 months using 2 × 3 factorial (2 AYB cultivars and 3 storage methods) in 3 replicates. The proximate analysis of the stored AYB seeds was carried out at 3 and 6 months after storage using standard methods. The temperature and relative humidity of the store room were recorded monthly with kestrel pocket weather tracker 4000. Seeds stored in jute bags gave the best values for crude protein (24.87%), ash (5.69%) and fat content (6.64%) but recorded least values for crude fibre (2.55%), carbohydrate (50.86%) and moisture content (12.68%) at the 6th month of storage. Temperature of the store room decreased from 32.9 ºC - 28.3ºC, while the relative humidity increased from 78% - 86%. Decreased incidence of field fungi namely: *Rhizopus oryzae, Aspergillus flavus, Geotricum candidum, Aspergillus fumigatus* and *Mucor meihei* was accompanied by increase in storage fungi viz: *Apergillus niger, Mucor hiemalis, Penicillium espansum* and *Penicillium atrovenetum* with prolonged storage. The study showed that of the three storage materials jute bag was more effective at preserving AYB seeds.

Keywords—Storage Methods, Proximate Composition, African Yam Bean, Fungi.

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Body Height, Weight and Body Mass Index Prediction Model on Young Adult in Javanese, Madurese and Using Ethnic

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Abstract—Body height, weight and BMI are three important anthropometric components in medical fields, nutritional care and in describing the prevalence of risk factors in the population. However, a person with disabilities, bed rest patient and obesity adult can't be measured directly so that another anthropometric measurements alternatives are needed using other body parts. Indonesia has 250 ethnics with different characteristics and research on prediction models based on Indonesian ethnics are still limited. Therefore the aim of this research is to produce prediction models of height, weight and BMI in young adults Javanese, Madurese and Using. The research design used was cross sectional on 202 respondents aged 20 – 40 years consisting of 73 men and 129 women, with 66 Javanese from Jember district, 69 Madurese from Jember and Situbondo district and 68 Using from Banyuwangi district. The result showed that body parts that used on this research have moderate – very strong correlation with height, weight and BMI. The body part correlated srongly is the right knee height (r = 0,879) with the height, the left MUAC (r = 0,899) with the weight and (r = 0,894) with BMI. When the ethnic variables are not included in the analysis, it produces prediction models of height, weight and BMI with small mean difference compared to the actual value so that the prediction models regardless of ethnic variables are more applicable on the field.

Keywords—body mass index, BMI, height, prediction model, weight

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Reallocation of Bed Capacity in a Hospital Combining Discrete Event Simulation and Integer Linear Programming

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Abstract—The number of inpatient admissions in the UK have been significantly increasing over the past decade. These increases cause bed occupancy rates to exceed the target level (85%) set by the Department of Health in England. Therefore, hospital service managers are struggling to better manage key resource such as beds. On the other hand, this severe demand pressure might lead to confusion in wards. For example, patients can be admitted to the ward of another inpatient specialty due to lack of resources (i.e. bed). This study aims to develop a simulation-optimization model to reallocate the available number of beds in a mid-sized hospital in the UK. A hospital simulation model was developed to capture the stochastic behaviours of the hospital by taking into account the accident and emergency department, all outpatient and inpatient services, and the interactions between each other. A couple of outputs of the simulation model (e.g. average length of stay and revenue) were generated as inputs to be used in the optimization model. An integer linear programming was developed under a number of constraints (financial, demand, target level of bed occupancy rate and staffing level) with the aims of maximizing number of admitted patients. In addition, a sensitivity analysis was carried out by taking into account unexpected increases on inpatient demand over the next 12 months. As a result, the major findings of the approach proposed in this study optimally reallocate the available number of beds for each inpatient speciality and reveal that 74 beds are idle. In addition, the findings of the study indicate that the hospital wards will be able to cope with 14% demand increase at most in the projected year. In conclusion, this paper sheds a new light on how best to reallocate beds in order to cope with current and future demand for healthcare services.

Keywords—Bed occupancy rate, bed reallocation, discrete event simulation, inpatient admissions, integer linear programming, projected usage.

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Soil and the Gut Microbiome: Supporting the 'Hygiene Hypothesis'

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Abstract—Background: According to the 'hygiene hypothesis' the current rise in allergies and autoimmune diseases stems mainly from reduced microbial exposure due, amongst other factors, to urbanisation and distance from soil. However, this hypothesis is based on epidemiological and not biological data. Useful insights into the underlying mechanisms of this hypothesis can be gained by studying our interaction with soil. Soil microbiota may be directly ingested or inhaled by humans, enter the body through skin-soil contact or using plants as vectors. This study aims to examine the ability of soil microbiota to colonise the gut, study the interaction of soil microbes with the immune system and their potential protective activity. Method: The nutrition of the rats was supplemented daily with fresh or autoclaved soil for 21 days followed by 14 days of no supplementations. Faecal samples were collected throughout and analysed using 16S sequencing. At the end of the experiment rats were sacrificed and tissues and digesta were collected. Results/Conclusion: Results showed significantly higher richness and diversity following soil supplementation even after recovery. Specific soil microbial groups identified as able to colonise the gut. Of particular interest was the mucosal layer which emerged as a receptive host for soil microorganisms. Histological examination revealed innate and adaptive immune activation. Findings of this study reinforce the 'hygiene hypothesis' by demonstrating the ability of soil microbes to colonise the gut and activate the immune system. This paves the way for further studies aimed to examine the interaction of soil microorganisms with the immune system.

Keywords—gut microbiota, hygiene hypothesis, microbiome, soil

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The Mechanism of *Parabacteroides goldsteinii* on Immune Modulation and Anti-Obsogenicity

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Abstract—It is urgent that novel anti-obesity measures that are safe, effective and widely available are developed for counteracting the rapidly growing obesity epidemics. In the present study, we show that a probiotic bacterium *Parabacteroides goldsteinii* screened through culture under the high molecular weight polysaccharides prepared from two iconic medicinal fungi, the Ganoderma lucidum and the Hirsutella sinensis, reduced body weight by ca. 20% in high-fat diet (HFD)-fed mice. The bacterium also decreased intestinal permeability, metabolic endotoxemia, inflammation and insulin resistance. Notably, oral administration of live, but not high temperature-killed, P. goldsteinii to HFD fed mice considerably reduces weight gain and obesity-associated metabolic disorders. A three months feeding of the mice with P. goldsteinii did not show any aberrant side effects, indicating the safety of this bacterium. Transcriptome analysis indicated that P. goldsteinii enhances immunity in resting dendritic cells, but reduces inflammation in lipopolysaccharide (LPS)-induced dendritic cells. On top, Naïve T-cells were skewed towards regulatory T-cells after encountering with dendritic cells (DCs) pretreated with P. goldsteinii. These results indicated P. goldsteinii showed anti-inflammatory effects and can work as a potential probiotic ameliorating obsogenicity and related metabolic syndromes.

Keywords—*Parabacteroides goldsteinii,* Gut microbiome, Obesity, Immune modulation.

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Vitex agnus-castus Anti-Inflammatory, Antioxidants Characters and Anti-Tumor Effect in Ehrlich Ascites Carcinoma Model

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Abstract—Objective: Appreciation of *in-vitro* anti-inflammatory and antioxidant characters of *Vitex agnus-castus* berries alcoholic extract and fractions, as well as *in-vivo* antitumor ability of alcoholic extract and chloroform fraction against Ehrlich ascites carcinoma is the aim of this study.

Material and methods: Antioxidant properties of crude alcoholic extract of vitex berries as well as petroleum ether, chloroform, ethyl acetate and butanol fractions were evaluated, *in-vitro* assessments, as compared with standard materials, l-ascorbic acid (vitamin C) and butylated hydroxyl toluene(BHT). The anti-inflammatory activity was investigated in cyclooxygenase (COX)-1 and COX-2 inhibition assays. Moreover, *in-vivo* antitumor effect of vitex berries alcoholic and chloroform extracts were evaluated using Ehrlich ascites carcinoma model. Data were presented as mean±SE, and data were analyzed by one-way analysis of variance test.

Results and conclusion: Berries crude extract showed potent antioxidant activity followed with its fractions ethyl acetate and chloroform as compared with standard (V.C and BHT). Ethyl acetate fraction showed good reduction capability, metal ion chelation, hydrogen peroxide scavenging, nitric oxide scavenging and superoxide anion scavenging. Meanwhile, chloroform fraction produced the highest free radical scavenging activity and total antioxidant capacity. In respectable of lipid peroxidation inhibition, crude alcoholic extract and its fractions cleared weak inhibition in comparing with standard materials. Anti-inflammatory activity of *V. agnus-castus* berries chloroform fraction of vitex was best COX-2 inhibitor (IC$_{50}$, 135.41 µg/ ml) as compared to vitex alcoholic extract or ethyl acetate fraction with weak inhibitory effect on COX-1 (IC$_{50}$, 778.432 µg/ ml), where the lowest effect on COX-1 was recorded with alcoholic extract. Alcoholic extract and its fractions showed weak COX-1 inhibition activity, whereas COX-2 was inhibited (100%), compared with celecoxib drug (72% at 1000ppm). The crude alcoholic and chloroform extracts of V. *agnus-castus* barries significantly reduced the viable Ehrlich cell count and increased nonviable count with amelioration of all hematological parameters. This amelioration was reflected on increasing median survival time and significant increase (P<0.05) in lifespan.

Keywords—Anti-inflammatory. Antioxidants, Ehrlich Ascites Carcinoma, *Vitex agnus-castus.*

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Satureja Montana Aqueous Extract and Volatile Oil as Antiradical Activity, Cytotoxicity and Apoptosis Gene Expression Profile

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Abstract—Objective: *Satureja montana L.* is a deciduous perennial shrub grown in Egypt. Its extracts and essential oil used as herbal remedies of many diseases. This study designed to investigate antiradical properties of *Satureja Montana* aqueous extract and volatile oil as well as elucidate the molecular mechanisms underlying the induction of cytotoxic effects in HepG2 cells. Material and Methods: HepG2 cells were injected by aqueous extract and volatile oil at five different concentrations ranging (12.5- 200 μg/ml). Antioxidant activities of *Satureja Montana* aqueous extract as well as volatile oil were evaluated, *in-vitro* assessments, as compared with standard materials, l-ascorbic acid (vitamin C) using DPPH and ABTS radical-scavenging activity and reducing power assay. In addition, total phenolic and flavonoid contents were carried out by spectroscopic analysis. Cytotoxicity was assessed by a tetrazolium-based colorimetric assay (MTT) and Reverse transcription-polymerase chain reaction (RT-PCR) to analyze the mRNA expression levels of Bcl-2, Bax and caspase-3 gene expression. Results and conclusion: *S. Montana* extract and essential oil exhibited antioxidant activity. Volatile oil showed potent antioxidant activity and highest content of Total phenolic compounds followed by aqueous extract as compared with standard materials. Essential oil appeared the highest reduction capability free radical scavenging activity and total antioxidant capacity followed by water extract compared with standard material (Vitamin C) they significantly inhibited radical-scavenging gradually with increasing concentration to obtain the maximum inhibitory effect at 200 μg/ ml. Meanwhile, aqueous extract showed low content of phenolic compounds compared with essential oil (188.21 and 290.18 mg GAL /g), respectively. Moreover, the two tested compounds showed concentration dependent increase in the growth inhibition percentage against HepG2 cell line. Reverse transcription-polymerase chain reaction analysis demonstrated that either *S. Montana* extract or volatile oil up-regulated HepG-2 Bax and caspase-3 mRNA expression and down-regulated Bcl-2 mRNA expression. Greater alterations in Bax, Bcl-2 and caspase-3 expression were observed with essential oil than aqueous extract. The decrease in Bcl-2, increase in Bax and, finally, the activation of caspase-3 in HepG2 cells indicated that the apoptotic process induced by *Satureja Montana* was irreversible. The results of the present study, allowed proving that *S. montana* growing in Egypt contains a high content of phenolic and flavonoid compounds which could be responsible for a remarkable radical scavenging and antioxidant properties as well as induced HepG2 cell apoptosis via the activation of mitochondrial apoptotic pathways observed.

Keywords—Antiradical activity, apoptosis- gene expression, cytotoxicity, *Satureja Montana*.

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The Effect of Heat Stress on the Gastro-Intestinal Microbiota of Pigs

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Abstract—Heat stress (HS) negatively affects the physiology of pigs. In this study, 6 pigs will be subjected to temperatures of 35 ± 2℃ for 12 hrs/day for a duration of 21 days. The changes in the gastrointestinal tract (GIT) microbiota will be observed by analyzing the freshly collected faeces on days 1, 3, 7, 14 and 21. The changes will be compared to faeces from a set of 6 control pigs kept simultaneously at temperatures of 26 ± 2℃ for the same duration of 21 days. Different types of stresses such a weaning have a detrimental effect on GIT microflora. Similarly, HS is expected to have a harmful effect on the microbial diversity of the GIT. How these changes affect the immune system of the pigs will be studied and therapeutics to reduce the negative effects of HS will be developed.

Keywords—GIT microbiota, heat stress, immune system, therapeutics

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Cytotoxic, Antimicrobial and Antiviral Activities of Acovenoside A: A Cardenolide Isolated from an Egyptian Cultivar of Acokanthera spectabilis Leaves

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Abstract—Acokanthera oblongifolia (Apocynaceae) is used for treatment of several infection diseases and is a well-known cardiac glycoside-containing plant. The infusion of their leaves is gargled to treat tonsillitis and is used medicinally to treat snakebites. The total cardiac glycosides content in the leaves was determined by referring to gitoxigenin as a reference compound. Two triterpenes, lup-20(29--en-3β-ol (1) and oleanolic acid (2); two cardenolides, acovenoside A (3) and acobioside A (4) were isolated from the ethyl acetate extract. Their structures were determined on the basis of spectral analysis. Major constituents isolated from this species were evaluated for cytotoxicity against normal lung cell line (Wi38) and antimicrobial activities against Gram-positive (two strains) and Gram-negative bacteria (four strains), yeast-like fungi (two strains) and fungi (five strains). The minimum inhibitory concentration (MIC) of the compounds was determined using broth microdilution method. Their viral inhibitory effects against avian influenza virus type A (AI-H5N1) and Newcastle disease virus (NDV) in specific pathogen free (SPF) embryonated chicken eggs (ECE), chicken embryo fibroblasts (CEF) and Vero cells were evaluated. The cardenolide (3) showed viral inhibitory effects against AI-H5N1 and NDV in SPF ECE. The two cardenolides isolated have shown potent cytotoxicity against Vero cells. Compound (3) showed potent anti-Gram-negative bacteria activity. These results suggested that acovenoside A might be promising for future antiviral and antimicrobial drug design.

Keywords—Acokanthera, AI-H5N1, Cardenolides, NDV, SPF-ECE, VERO, Wi38 , Microbe

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Characterization of the Blood Microbiome in Rheumatoid Arthritis Patients Compared to Healthy Control Subjects Using V4 Region 16S rRNA Sequencing

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Abstract—Rheumatoid arthritis (RA) is a disabling and common autoimmune disease during which the body's immune system attacks healthy tissues. This results in complicated and long-lasting actions being carried out by the immune system, that typically only occurs when the immune system encounters a foreign object. In the case of RA, the disease affects millions of people and causes joint inflammation, ultimately leading to the destruction of cartilage and bone. Interestingly, the disease mechanism still remains unclear. It is likely that RA occurs as a result of a complex interplay of genetic and environmental factors including an imbalance in the microorganism population inside our body. The human microbiome or microbiota is an extensive community of microorganisms in and on the bodies of animals, that comprises bacteria, fungi, viruses and protozoa. Recently, the development of molecular techniques to characterize entire bacterial communities has renewed interest in the involvement of the microbiome in the development and progression of RA. We believe that an imbalance in some of the specific bacterial species in the gut, mouth and other sites may lead to atopobiosis; the translocation of these organisms into the blood, and that this may lead to changes in immune system status. The aim of this study was, therefore, to characterize the microbiome of RA serum samples in comparison to healthy control subjects using 16S rRNA gene amplification and sequencing. Serum samples were obtained from healthy control volunteers and from patients with RA both prior to, and following treatment. The bacterial community present in each sample was identified utilizing V4 region 16S rRNA amplification and sequencing. Bacterial identification, to the lowest taxonomic rank, was performed using a range of bioinformatics tools. Significantly, the proportions of the Lachnospiraceae, Ruminococcaceae, and Halmonadaceae families were significantly increased in the serum of RA patients compared with healthy control serum. Furthermore, the abundance of Bacteroides and Lachnospiraceae nk4a136_group, Lachnospiraceae_UGC-001, RuminococcaceaeUCG-014, Rumnococcus-1 and Shewanella was also raised in the serum of RA patients relative to healthy control serum. These data support the notion of a blood microbiome and reveal RA-associated changes that may have significant implications for biomarker development and may present much-needed opportunities for novel therapeutic development.

Keywords—Blood Microbiome**,** gut and oral bacteria, Rheumatoid arthritis, 16S rRNA gene sequencing.

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The Effect of Different Metal Nanoparticles on Growth and Survival of Pseudomonas syringae Bacteria

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Abstract—The Pseudomonas syringae species complex includes many plant pathogenic strains with highly specific interactions with varied host species and cultivars. The rapid spread of these bacteria over the last ten years has become a cause for concern. Nanoparticles have previously shown promise in microbiological action. We have therefore investigated in vitro and in vivo the effects of different types and sizes of nanoparticles in order to provide quantitative information about their effect on the bacteria. The effects of several different nanoparticles against several bacteria strains were investigated. The effect of NP on bacterial growth was studied by measuring the optical density, biochemical and nutritional tests, and transmission electron microscopy (TEM) to determine the shape and size of NP. Our results indicate that their effects varied, with either a negative or a positive impact on both bacterial and plant growth. Additionally, the methods of exposure to nanoparticles have a crucial role in accumulation, translocation, growth response and bacterial growth. The results of our studies on the behaviour and effects of nanoparticles in model plants showed. Cerium oxide (CeO_2) and silver (Ag) NP showed significant antibacterial activity against several pathogenic bacteria. It was found that titanium nanoparticles (TiO_2) can have either a negative or a positive impact, according to concentration and size. It is also thought that environmental conditions can have a major influence on bacterial growth. Studies were therefore also carried out under some environmental stress conditions to test bacterial survival and to assess bacterial virulence. All results will be presented including information about the effects of different nanoparticles on Pseudomonas syringae bacteria.

Keywords—plant microbiome, nanoparticles, 16S rRNA gene sequencing, bacterial survival

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The Gut Microbiome in Cirrhosis and Hepatocellular Carcinoma: Characterization of Disease-Related Microbial Signature and the Possible Impact of Life Style and Nutrition

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Abstract—Introduction: Hepatocellular carcinoma (HCC) is one of the leading causes of cancer related mortality worldwide. Liver Cirrhosis is the main predisposing risk factor for the development of HCC. The factor(s) influencing disease progression from Cirrhosis to HCC remain unknown. Gut microbiota has recently emerged as a major player in different liver diseases, however its association with HCC is still a mystery. Moreover, there might be an important association between the gut microbiota, nutrition, life style and the progression of Cirrhosis and HCC. The aim of our study was to characterize the gut microbial signature in association with life style and nutrition of patients with Cirrhosis, HCC-Cirrhosis and healthy controls.

Design: Stool samples were collected from 95 individuals (30 patients with HCC, 38 patients with Cirrhosis and 27 age, gender and BMI-matched healthy volunteers). All participants answered lifestyle and Food Frequency Questionnaires. 16S rRNA sequencing of fecal DNA was performed (MiSeq Illumina).

Results: There was a significant decrease in alpha diversity in patients with Cirrhosis (qvalue=0.033) and in patients with HCC-Cirrhosis (qvalue=0.032) compared to healthy controls. The microbiota of patients with HCC-cirrhosis compared to patients with Cirrhosis, was characterized by a significant overrepresentation of Clostridium (pvalue=0.024) and CF231 (pvalue=0.010) and lower expression of Alphaproteobacteria (pvalue=0.039) and Verrucomicrobia (pvalue=0.036) in several taxonomic levels: Verrucomicrobiae, Verrucomicrobiales, Verrucomicrobiaceae and the genus Akkermansia (pvalue=0.039). Furthermore, we performed an analysis of predicted metabolic pathways (Kegg level 2) that resulted in a significant decrease in the diversity of metabolic pathways in patients with HCC-Cirrhosis (qvalue=0.015) compared to controls, one of which was amino acid metabolism. Furthermore, investigating the life style and nutrition habits of patients with HCC-Cirrhosis, we found significant correlations between intake of artificial sweeteners and Verrucomicrobia (qvalue=0.12), High sugar intake and Synergistetes (qvalue=0.021) and High BMI and the pathogen Campylobacter (qvalue=0.066). Furthermore, overweight in patients with HCC-Cirrhosis modified bacterial diversity (qvalue=0.023) and composition (qvalue=0.033).

Conclusions: To the best of the our knowledge, we present the first report of the gut microbial composition in patients with HCC-Cirrhosis, compared with Cirrhotic patients and healthy controls. We have demonstrated in our study that there are significant differences in the gut microbiome of patients with HCC-cirrhosis compared to Cirrhotic patients and healthy controls. Our findings are even more pronounced because the significantly increased bacteria Clostridium and CF231 in HCC-Cirrhosis weren't influenced by diet and lifestyle, implying this change is due to the development of HCC. Further studies are needed to confirm these findings and assess causality.

Keywords—Cirrhosis, Hepatocellular carcinoma, life style, liver disease, microbiome, nutrition.

Microbial Dark Matter Analysis Using 16S rRNA Gene Metagenomics Sequences

Hana Barak, Alex Sivan, Ariel Kushmaro

Abstract—Microorganisms are the most diverse and abundant life forms on Earth and account for a large portion of the Earth's biomass and biodiversity. To date though, our knowledge regarding microbial life is lacking, as it is based mainly on information from cultivated organisms. Indeed, microbiologists have borrowed from astrophysics and termed the 'uncultured microbial majority' as 'microbial dark matter'. The realization of how diverse and unexplored microorganisms are, actually stems from recent advances in molecular biology, and in particular from novel methods for sequencing microbial small subunit ribosomal RNA genes directly from environmental samples termed next-generation sequencing (NGS). This has led us to use NGS that generates several gigabases of sequencing data in a single experimental run, to identify and classify environmental samples of microorganisms. In metagenomics sequencing analysis (both 16S and shotgun), sequences are compared to reference databases that contain only small part of the existing microorganisms and therefore their taxonomy assignment may reveal groups of unknown microorganisms or origins. These unknowns, or the 'microbial sequences dark matter', are usually ignored in spite of their great importance. The goal of this work was to develop an improved bioinformatics method that enables more complete analyses of the microbial communities in numerous environments. Therefore, NGS was used to identify previously unknown microorganisms from three different environments (industrials wastewater, Negev Desert's rocks and water wells at the Arava valley). 16S rRNA gene metagenome analysis of the microorganisms from those three environments produce about ~4 million reads for 75 samples. Between 0.1-12% of the sequences in each sample were tagged as 'Unassigned'. Employing relatively simple methodology for resequencing of original gDNA samples through Sanger or MiSeq Illumina with specific primers, this study demonstrates that the mysterious 'Unassigned' group apparently contains sequences of candidate phyla. Those unknown sequences can be located on a phylogenetic tree and thus provide a better understanding of the 'sequences dark matter' and its role in the research of microbial communities and diversity. Studying this 'dark matter' will extend the existing databases and could reveal the hidden potential of the 'microbial dark matter'.

Keywords—bacteria, bioinformatics, dark matter, Next Generation Sequencing, unknown

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Characterization of the Intestinal Microbiota: A Signature in Fecal Samples from Patients with Irritable Bowel Syndrome

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Abstract—Irritable bowel syndrome (IBS) is a common bowel disorder which is usually diagnosed through the abdominal pain, fecal irregularities and bloating. Alteration in the intestinal microbial composition is implicating to inflammatory and functional bowel disorders which is recently also noted as an IBS feature. Owing to the potential importance of microbiota implication in both efficiencies of the treatment and prevention of the diseases, we examined the association between the intestinal microbiota and different bowel patterns in a cohort of subjects with IBS and healthy controls. Fresh fecal samples were collected from a total of 50 subjects, 30 of whom met the Rome IV criteria for IBS and 20 Healthy control. Total DNA was extracted and library preparation was conducted following the standard protocol for small whole genome sequencing. The pooled libraries sequenced on an Illumina Nextseq platform with a 2×150 paired-end read length and obtained sequences were analyzed using several bioinformatics programs. The majority of sequences obtained in the current study assigned to bacteria. However, our finding highlighted the significant microbial taxa variation among the studied groups. The result, therefore, suggests a significant association of the microbiota with symptoms and bowel characteristics in patients with IBS. These alterations in fecal microbiota could be exploited as a biomarker for IBS or its subtypes and suggest the modification of the microbiota might be integrated into prevention and treatment strategies for IBS.

Keywords—Irritable bowel syndrome, intestinal microbiota, small whole genome sequencing, fecal samples, Illumina.

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Scalable and Accurate Detection of Pathogens from Whole-Genome Shotgun Sequencing

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Abstract—Next-generation sequencing, especially whole genome shotgun sequencing is becoming a common approach to gain insight into the microbiomes in a culture-independent way, even in clinical practice. It does not only give us information about the species composition of an environmental sample but opens the possibility to detect antimicrobial resistance and novel, or currently unknown, pathogens. Accurately and reliably detecting the microbial strains is a challenging task. Here we present a sensitive approach for detecting pathogens in metagenomics samples with special regard to detecting novel variants of known pathogens.

We have developed a pipeline that uses fast, short read aligner programs (i.e. Bowtie2/BWA) and comprehensive nucleotide databases. Taxonomic binning is based on the lowest common ancestor (LCA) principle; each read is assigned to a taxon, covering the most significantly hit taxa. This approach helps in balancing between sensitivity and running time. The program was tested both on experimental and synthetic data.

The results implicate that our method performs as good as the state-of-the-art BLAST-based ones, furthermore, in some cases, it even proves to be better, while running two orders magnitude faster. It is sensitive and capable of identifying taxa being present only in small abundance. Moreover, it needs two orders of magnitude less reads to complete the identification than MetaPhLan2 does.

We analyzed an experimental anthrax dataset (B. anthracis strain BA104). The majority of the reads (96.50%) was classified as Bacillus anthracis, a small portion, 1.2%, was classified as other species from the Bacillus genus. We demonstrate that the evaluation of high-throughput sequencing data is feasible in a reasonable time with good classification accuracy.

Keywords—Metagenomics, taxonomy binning, pathogens, microbiome, b. anthracis.

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The Role of Oral and Intestinal Microbiota in European badgers (Meles meles)

Emma J. Dale, Christina D. Buesching, Kevin R. Theis, David W. Macdonald

Abstract—This study investigates the oral and intestinal microbiomes of wild-living European badgers (*Meles meles*) and will relate inter-individual differences to social contact networks, somatic and reproductive fitness, varying susceptibility to bovine tuberculous (bTB) and to olfactory advertisement. Badgers are an interesting model for this research, as they have great variation in body condition, despite living in complex social networks and having access to the same resources. This variation in somatic fitness, in turn, affects breeding success, particularly in females. We postulate that microbiota have a central role to play in determining the successfulness of an individual.

Our preliminary results, characterising the microbiota of individual badgers, indicate unique compositions of microbiota communities within social groups of badgers. This basal information will inform further questions related to the extent microbiota influence fitness. Hitherto, the potential role of microbiota has not been considered in determining host condition, but also other key fitness variables, namely; communication and resistance to disease.

Badgers deposit their faeces in communal latrines, which play an important role in olfactory communication. Odour profiles of anal and subcaudal gland secretions are highly individual-specific and encode information about group-membership and fitness-relevant parameters, and their chemical composition is strongly dependent on symbiotic microbiota.

As badgers sniff/ lick (using their Vomeronasal organ) and over-mark faecal deposits of conspecifics, these microbial communities can be expected to vary with social contact networks. However, this is particularly important in the context of bTB, where badgers are assumed to transmit bTB to cattle as well as conspecifics. Interestingly, we have found that some individuals are more susceptible to bTB than are others. As acquired immunity and thus potential susceptibility to infectious diseases are known to depend also on symbiotic microbiota in other members of the mustelids, a role of particularly oral microbiota can currently not be ruled out as a potential explanation for inter-individual differences in infection susceptibility of bTB in badgers.

Tri annually badgers are caught in the context of a long-term population study that began in 1987. As all badgers receive an individual tattoo upon first capture, age, natal as well as previous and current social group-membership and other life history parameters are known for all animals. Swabs (subcaudal 'scent gland', anal, genital, nose, mouth and ear) and fecal samples will be taken from all individuals, stored at -80°C until processing. Microbial samples will be processed and identified at Wayne State University's Theis (Host-Microbe Interactions) Lab, using High Throughput Sequencing (16S rRNA-encoding gene amplification and sequencing).

Keywords—Communication, energetics, fitness, free-ranging, immunology.

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The Evaluation of Hearing Protectors and Noise-Induced Hearing Loss of Workers

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Abstract—Background: using the ear protectors is one of the most common method of control against exposure to noise of workers and a tool to prevent the noise- induced hearing loss. The questions may be posed about the efficiency of the hearing protectors in the field where the workers are exposed to high levels of noise. This study was designed to evaluate of hearing protectors in exposure to high levels of noise. Methods: Sound pressure microphone were placed in a real ear canal. The severity of noise measured inside and outside of ear canal. The noise reduction values due to installing ear protectors were calculated in the octave band frequencies and Labview programmer. The method has also done on a simulated ear canal to make a comparison of results with real canal data. Results: A difference between the overall sound pressure level is observed inside and outside of ear canal. The effectiveness of ear protectors have been considerably reduced for the low frequency limits. A change in resonance frequency also was observed after using ear protectors. Conclusions: The study indicated the ear canal structure may affect the received noise and it may lead a difference between the received sound from the measured sound by a sound level meter, and hearing system. It means the human hearing system may probably respond different from a sound level meter. Hearing protectors' efficiency decline by increasing the noise levels particularly for low frequency noise. Hearing protectors may cause changing the human hearing system acoustical structure. We need developing the subjective method of hearing protectors testing, because their evaluation are not designed based on industrial noise or in the field.

Keywords—noise, hearing loss, hearing protector, workers

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Fetal Gut Microbiota in Mice-Genomics and Proteomics Analysis of Its Origin and Factors Modulating Its Development

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Abstract—Formation of primary gut microbiota in early life development is extremely important in developing a balance between health and disease. The fetal gut microbiome has not been robustly investigated, despite recent demonstrations of intracellular microorganisms with diverse metabolic and immune regulatory functions. The formation of the primary gut microbiota in early life development is important in developing newborn immune system responses. Maternal microbes are transferred to their offspring during the labor, showing its importance in the colonization of the infant's gut. Until now, the course of pregnancy was believed to be a sterile environment (free of microbial communities). However, recent studies have suggested that microbial populations are present in the fetal gut also prior to birth. Animal studies have proven that prenatal transmission of microbes to the fetus is possible. Our preliminary results have already identified the first signature of microbial presence during embryo development, showing that first colonization most likely occurs prenatally. However, direct evidence of utero transfer of microbiota is still lacking. Therefore, improving our knowledge on factors, physiological mechanisms and modifiers involved in shaping the first formation of the gut is crucial for assessing the early life gut microbiome and their potential role in early life infant health, since the microbiome can influence the balance between health and disease. Furthermore, the influence of the maternal gut microbiome on the future risk of diseases of the fetus and the offspring is still to be determined. The present study with the use of developing modern metagenomics (NGS) and proteomics (MALDI-IMS) approach for the first time looks at the origin of fetal gut microbiota (focusing on bacterial and fungi species), and indicates its exact route of transmission, by investigating several aspects i) relationship between embryo implantation and primary gut microbiota formation ii) fetal and subsequently newborn immunological responses to mother common urinary tract infections iii) impact from modulation of commensal microbiota on the primary gut microbiota development. These innovative studies improve our understanding and provide new knowledge on factors enabling the microbiota formation, maintenance, prevalence its stability, and modulation its resources, which is particularly important for disease predisposition and treatment, and prevention prognosis. In the future, results of these studies will allow identifying possible novel probiotics, to become potential new treatment for UTIs. Progress in this area can open a new window into further clinical research and bring a potential alternative treatment for curing many infections by restoring gut microbiota homeostasis.

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Studying Second Language Development from a Complex Dynamic Systems Perspective

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Abstract—This paper discusses the application of complex dynamic system theory (DST) to the study of individual differences in second language development. This transdisciplinary framework allows researchers to view the trajectory of language development as a dynamic, non-linear process. A DST approach views language as multi-componential, consisting of multiple complex systems and nested layers. These multiple components and systems continuously interact and influence each other at both the macro- and micro-level. Dynamic systems theory aims to explain and describe the development of the language system, rather than make predictions about its trajectory. Such a holistic and ecological approach to second language development allows researchers to include various research methods from neurological, cognitive, and social perspectives.

A DST perspective would involve in depth analyses as well as mixed methods research. To illustrate, a neurobiological approach to second language development could include non-invasive neuroimaging techniques such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) to investigate areas of brain activation during language-related tasks. A cognitive framework would further include behavioural research methods to assess the influence of intelligence and personality traits, as well as individual differences in foreign language aptitude, such as phonetic coding ability and working memory capacity. Exploring second language development from a DST approach would also benefit from including perspectives from the field of applied linguistics, regarding the teaching context, second language input, and the role of affective factors such as motivation. In this way, applying mixed research methods from neurobiological, cognitive, and social approaches would enable researchers to have a more holistic view of the dynamic and complex processes of second language development.

Keywords—Dynamic systems theory, mixed methods, second language development.

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Tracing the Concept of Female Body in Sara Kane's Blasted from the Point of View of Ewa Kuryluk

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Abstract: one of the key terms in the present paper is female **grotesque**. The author tends to see how the play can be read in this respect. The point is that the narrative within this play tries to penetrate gender and sexual identities through the violence. This violence is not related to any gendered or sexual identity, whether male or female, it seems that Kane wants to put an end to these norms.

This paper includes a woman, fictional or real, this woman symbolizes the female grotesque. She carnivalized by her society and brings about the inversion, comedy, and tragedy of her play worlds. She has the capacity to become the ideal, but the society transforms her; She endures reinterpretation. The authors try to show that the female grotesque can be considered as a victim for male shortage, as a clarification of the weakness of society.

Keywords: Blasted, Ewa Kuryluk, Female body, Grotesque.

1. INTRODUCTION

In Blasted Cate, a 21 years old woman is the only female character who met Ian in the hotel room. She refuses to sleep with Ian frequently. According to Kuryluk the female grotesque takes blame for deficiency of men and explains the disorders of society [Kuryluk, 25]. In this play, Cate portrays a victim of Ian's mental and physical cruelty. She is raped off stage between the first and the second scene. Kane attributes Cate different physical characteristics.

The physical and mental innocence and un-worldliness of female body is presented through Cate in this play: "He stops and looks at Cate who is sucking her thumb."[Blasted , 4]. The same condition happens when Ian forces a kiss on her and starts to masturbate. Again, Cate starts to trembles and makes crying sounds and sucks her thumb. It can be concluded that she wants to return to the state of a child to refuse the womanly role imposed on her by Ian.

> CATE. Did I faint?
> IAN. That was real?
> CATE .Happens all the time.
> IAN. What, fits?
> CATE. Since Dad came back.
> IAN. Does it hurt?
> CATE. I'll grow out of it the doctor says.
> IAN .How do you feel?
> CATE .[Smiles] [Blasted, 9-10]

Cate's past is vague for the readers. It seems that she is in this hotel room to satisfy Ian sexually. Her body and her sexuality are at the center of attention. All the same Cate rejects this role that the authority intended for her and she tries to free herself from this situation by language and taking control of her own body and sexuality.

2. DETAILS

2.1 Ewa Kuryluk and the Concept of Female Body

She claims that the female grotesque takes blame for insufficiency of men and explains the disorders of society [Kuryluk, 25]. The carnival experience goes festival beyond the everyday life and transmit it to comedy and tragedy. The female grotesque occupies a secondary place but in accordance with the comic or tragic carnivalized world around her, she is considered as a major player.

In order to review the intricate consequence of the female grotesque, Kurylak goes beyond Bakhtin's interpretation of carnival as considering a dark world where the collapsing of society expressed through murder and degeneration. The female grotesque is waiting to "become" and to assume power. She often gives birth to social satire. The female grotesque, then, inhabits where comedy can transfer into tragedy and tragedy can transform into celebration.

The Bakhtin's grotesque body has been popular among feminist studies, which recognize the grotesque body with the female one. Consequently, Margaret Miles classifies the grotesque body as the female body which has her "individual configuration and boundaries" taken away through "menstruation, sexual intercourse, and pregnancy" [Bakhtin]. To her, the "central object of the grotesque figuration" involves sexual organs and activities [Bakhtin].

According to Kuryluk the female body and her sexual organs are central elements in the grotesque which is missing from the major scholarly studies because of their unawareness of the central role of female body.

Fertile femininity is traditionally adored , but we find that contacts with women are feared by primitive men throughout the world. This anguish is reflected in taboos imposed on women in early societies and in myths which recall in imprisonment within the female body. In those legends the danger of being captivated concerns not only real men but also diverse symbols of masculinity, as, for instance, the sun, which in the evening descends into the earth and in the morning has difficulties ascending from her womb. The weakness felt by men after sexual intercourse has probably contributed to the legend of the female vampire and the vagina with teeth [Kuryluk, 20].

In spite of the social equality at the heart of its founding socialist ideals, modern societies have been formed by a distinctly male discourse. Some women authors react to this reality by trying to emphasize a place for

women and their bodies through the demonstration of female characters who are strong and self-determining. Others, however, choose to ignore the outline of the discussion totally, moving beyond them to create a completely new bodily discourse. The aesthetics of the grotesque presents interpretive promises for recognizing that the aggression of modern society is always written on the woman's body.

The ascription of a central role to female body in grotesque illustration is not a dichotomy between male and female grotesque [Kuryluk, 16]. In fact, grotesque is generally portrayed through the presence of both genders and also animate and inanimate beings. So, because of the fundamental nature of the grotesque, the rejection of grotesque images of male sexuality is already out of question.

What Kuryluk and some other feminist scholars of the grotesque want to emphasize is the centrality of the female body in the making of the grotesque. Accordingly, Russo suggests that "female grotesque is crucial to the identity-formation of both men and women as a space of risk and abjection" [Russo, 12]. It is thus no exaggeration to indicate that female body has come to function as an elemental image in the determining of the grotesque. As Kuryluk mentions:"Because of the association with the womb and the cave, all closed spaces tend to be perceived as female and are associated with both protection and threat. Every closed space can be transformed into a cave-like shelter or prison by being isolated from the outside, painted black and darkened"[Kuryluk, 20].

Being grotesque can be the only weapon that help some female protagonists free themselves from the female roles that are stated by the authority [Kuryluk, 27]. Roughly speaking, a grotesque image does not only narrate the patterns of destruction or negativity, it can be considered as the only means for the salvation of a protagonist.

The feminists try to rearrange the body as the site of women's lived understanding. They are no longer restricted the body like in classical art. Instead, by regaining the body from patriarchy, they represent a concrete and delicate body; a body formed and marked by its internal functions as well as the social world [Miles, 34].

In this regard, Ewa Kuryluk believes that the grotesque is a device for questioning the role models of perfection that are informed by patriarchal cultures. Women who challenge the position of power are mostly to be seen as a threat, as rebellious elements that corrupt what is called normal in society. For her, such female protagonists who are seen as grotesque, because of their rebellious behavior and/or their imperfect bodies, use their grotesque characteristics to claim citizenship in a society in which there is no place for those who do not admit the pre-established rules of male and female normality.

Being grotesque can be considered as the only weapon that some female protagonists find to free themselves from the boundaries of the female roles that are stated by the ones in power. In other words, a grotesque image does not essentially relate to outlines of devastation or pessimism. The grotesque may be the only means for a protagonist's salvation.

The versatile grotesque images that women, and also men, may portray is also an essential turning point that Kane presents in her work. Kane breaks with the social principles of gender illustrations and also with grotesque

illustrations. The grotesque in her work represents, very often, a positive experience. It is by being grotesque that some of the her protagonists find freedom: a chance of rebirth from a symbolic death.

To sum up, in the twenty-first century the grotesque has been given transformed critical attention in miscellaneous fields such as art, literary theory, postcolonial studies, cultural studies, and more recently, feminism. While there has been an increasing interest in the feminist potentials and impact of such imagery in art and literature there is still much work to be done by feminists in gaining knowledge about the grotesque female body in performance.

The feminist movement becomes superior over the past one hundred years. Male way of thinking becomes socially acceptable so the male sex turns into a central force in society based on notions of gender. Gender, as a social formation, deals with femininity as a form of suppression. Feminist of the era felt that they need to modify the conventional image of the female form in art.

Ewa Kuryluk is responsible for pioneering a place for the grotesque in the language of feminist theory. Other theorists have discussed the role of the grotesque in gender construction, but few have developed a particularly feminist discourse of the grotesque.

2.2 Textual Analysis; Female Body in Blasted

According to Kuryluk femininity is respected by societies, but the world can never solve the problem of the imprisonment within the female body [Kuryluk, 20]. In the second half of the play, Cate is seen as a possible mother which can be considered as the most respectable role for the female body. She returns from the outside world destroyed by war with a baby left alone by its mother. The following part highlights the role of Cate and the importance of her femininity and Ian's effort for forcing Cate back to his world.

CATE. A woman gave me her baby.
IAN. You come for me Catie? Punish me or rescue me makes no difference I love you Cate tell him for me do it for me touch me Cate.

CATE. Don't know what to do with it.
IAN. I'm cold-
CATE. Keeps crying.
IAN. Tell him –
CATE. I CAN'T[Blasted, 53]

It should be noted that as Kuryluk believes the female body which is constructed by power relations tries to oppose the outside forces [Kuryluk, 31]. Cate's body is an obedient or a damaged body which can be considered as a confessing body to picture the cruelty and difficulties of Cate. Her bodily and psychic honesty is ruined and Ian uses her bodily expression against her stating: "Ian Thought you liked that. Cate. No. Ian Made enough noise" [Blasted, 31].

The physical violence does not only affect Cate's mental status but also controls her body directly. She is not able to perform the natural physical needs without being hurt. Cate also talks about the direct consequences Ian's rape had on her body: "Cate I can't piss. It's just blood. Ian Drink lots of water. Cate Or shit. It hurts" [Blasted,34].

In this play, Kane concentrates on the female body and the way sexual assault and male power define the way the body is seen not only by society but also by women themselves. Similarly to Kuryluk's theory the female body

is presented as a social structure which is continuously discussed by society and individual. It seems that the female character tries to break the roles and the power relations forced on her but she doesn't seem to be able to break out their prearranged roles.

As it was mentioned in the previous chapter, Kuryluk states that because of the nature of human anatomy, even the most sublimed fantasies of love are exposed to the presence of ridicules [Kuryluk, 21]. In this case, Cate laughs at Ian and alters the power toward her. When Ian undresses himself, she tells him that she doesn't like his clothes either and starts laughing, by this reaction she makes him weak and insecure. Roughly speaking, his body is judged only by Cate's reaction. Shivering and bursting into frantic laughing puts Cate in the position of the weak participant again but even in this situation Ian can't control her body.

In Blasted, Kane introduces a new element to the issue of gender through the brightly represented physical rape of the feminized male body, puzzled the status of rape as the female victim-only space. Although Sara kane's play Blasted is about many things, such as war, gender issues, and shortcomings of society, what really attracts the audience's attention is in particular the playwright's insistence on the clear demonstration of rape scenes.

In should be noted that as Kuryluk mentions, the structure of the female body has an essential role in a way that they are continuously surrounding their bodies against the male dominated environment. By losing control over their bodies, they actually blame themselves instead of the violating part. In Blasted Cate is attacked by Ian for not looking sexy enough for him but he attempts to get her to do oral sex.

IAN. watches her.
IAN. Don't like your clothes.
CATE. [Looks down at her clothes.]Ian You look like a lesbos.
CATE.What's that?
IAN. Don't look very sexy, that's all. CATE.Oh. [She continues to eat] Don't like your clothes either.
IAN. [looks down at his clothes. Then gets up, takes them all off and stands in front of her, naked.]Put your mouth on me.
CATE. [Stares. Then bursts out laughing.] IAN. No? Fine.
Because I stink?
CATE. [Laughs even more]
IAN.attempts to dress, but fumbles with embarrassment.[Blasted , 7-8]

The author mixes up the subjects and objects of rape and differs the modes she uses to represent the four different acts of rape portrayed in the play. The story expanded so that the ugliest rape in the play occurs to Ian, the male character. The reader may conclude that lastly the silence of the rape history was heard and the male was punished as a form of justice but the play instead presents rape as a practice of gender difference, dissimilarity and otherness. In Blasted, Kane's illustration of Cate's rape could be placed in the larger context of rape in our society where women were often seen as belongings of men. Consequently, rape is considered as an insult against male properties.

As it was mentioned earlier, throughout the play Kane repeatedly portrays Cate as a non-sexual. Cate pauses when Ian accuses her and her brother of being hindered but immediately answers to Ian's "I love you" with a "big smile, friendly and non-sexual" [B, 5]. On the other hand, later in the play Cate tries to seduce Ian by biting him in his penis so she actually repeals the roles of attacker and victim at that moment. She discards the aggressive acts Ian has forced her to. Kane writes: "Cate begins to cough and retch. She puts her fingers down her throat and produces a hair. She holds it up and looks at Ian in disgust. She spits"[Blasted,33].

Blasted inserts radical tones to the traditional image of rape which let the characters push the boundaries of a male on male rape. Sara kane in Blasted tries to portray the characters by rejecting the traditional heroes and characters. Her characters can be read as a post human. The characters that are out casted from the society use humor to punctuate the wounding of their bodies. As a normal character, Cate gets raped many times throughout the play.

Accurately, she is raped twice: in the beginning of the play and later outside of the hotel. Symbolically, she is also raped via language by Ian's verbal abuse. Whether she stays in a hotel or makes it to the outside world, what expects her is nothing but rape as if it is a common condition for a contemporary woman. When the Soldier understands that Cate has escaped the Leeds hotel through the bathroom window, he expects that she will be raped out. She belongs to the class of women and stays within the category of traditional social and sexual relations but the carnivalized Cate tries to free herself from these boundaries.

Cate comes back to the hotel room carrying a crying baby. Ian begs Cate to carry the soldier's gun and finish the job that the soldier started. When Cate tells Ian that God would not like killing yourself, he replies:" No God, no Father Charismas, no fairies, no Narnia, no fucking nothing"[Blasted, 55]. The comedy starts at the debate's conclusion. Ian puts the gun in his mouth but surprisingly wants Cate not to "stand behind me" [Blasted, 56]. Then laughter, Ian pulls the trigger but it is empty of bullets. Cate tells Ian" Fate, see. You are not meant to do it. God-"[Blasted, 57]. The audience is in on a joke that Ian can't see. Cate herself took the bullets out of gun; her fate on God's plan is not so firm. Again laugh but as soon as the empty gun hits the floor, Cate realizes that the baby in her hand died. From here laughter will be stopped and the carnivalised characters enter into tragedy.

The play still have one final joke, Cate buries the child and leaves Ian. He is hungry so he finds a final solution to his pain. He eats greedily the baby's corps and then climbs into the grave. Ian's suffering is not yet complete: "He dies with relief; it starts to rain on him, coming from the roof. Eventually. Ian: Shit" [Blasted, 60].

In another scene, the male protagonist Ian is dishonored only because he finds himself in the position of the symbolic female. It reveals the absoluteness of the object of rape as feminine. Through the frequent references to a symbolic female object, the Soldier feminizes Ian, forcing him into a passive role:
SOLDIER. Turnover, Ian.
IAN. Why?
SOLDIER. Going to fuck you.
IAN.No.
SOLDIER. Kill you then.

> IAN. Fine.
>
> SOLDIER. See. Rather be shot than fucked and shot.
>
> IAN. Yes.
>
> SOLDIER. You smell like her. Same cigarettes.
>
> The Soldier turns Ian over with one hand.
>
> He holds the revolver to Ian's head with the other.
>
> He pulls down Ian's trousers, undoes his own and rapes him
>
> – eyes closed and smelling Ian's hair.
>
> The Soldier is crying his heart out "[Blasted, 49].

The Soldier does not get distressed for not being able to carry an act of revenge toward Ian as an enemy male through raping his woman. He expects Cate to be raped anyway: "Gone. Taking a risk. Lot of bastard soldiers out there" [Blasted,38]. He knows that she cannot escape from the boundaries of society. At the end of Blasted, Cate returns to Ian who is now blind and totally dependent on her. Although she is the "stronger" one in their relationship, she is still not able to break out their unhealthy and repressing connection.

The status of the characters remains vague. If Cate as claims, there will be afterlife, then Ian's discovery is that it is no better than this world. In that world, people will be hungry and get wet. If he is still alive, his chance of dying "with relief "has been let down by nature.

By portraying female character throughout the play, it is hard to make a clear distinction between victims and perpetrators. The playwright generates characters that in spite of showing the ability to impose mental and physical torture on other people have an "underlying fragility, a desire to be loved and an almost pathetic tenderness that often lurks beneath their cruelty"[Saunders, 32].

CONCLUSIONS

The female body is isolated from common life and is constrained within its own damaged, anxious or ugly and deformed imprisonment of the flesh. The main characters of the selected plays are all modern men; unusual and destructive, but separated and degraded as well. They are all intertwined with emotional and sensual or physical difficulties in their lives; they are disregarded, betrayed and tormented through their bodies and physical life.

REFERENCES
1. Kane, Sarah. Blasted. New York: Bloomsbury Academic, 2002. Print.
2. . Kuryluk, Ewa. Salome and Judas in the Cave of Sex. Evanston: Northwestern University   Press, 1987. Print
3. Saunders, Graham. Love me or kill me: Sara kane and the Theatre of Extremes, New York: Manchester: UP. 2002. Print.
4.
5. Sierz, Aleks. "Sara kane." In-yer-face Theatre: British Drama Today. London: Faber
6.   and Faber, 2001. 90-121. Print.
7. Termiazi, Arbaayah . Grotesque Representations of Deviant Sexuality in Ian McEwan's
8.   Selected Short Stories. Social Sciences and Humanities.9 Nov 2013:131-142.Print.
9. Thomson, Philip. The Grotesque. London: Routledge, 1972. Print.
10. Zhurba, Dina. The Endangered Representation of Sexual Violence in Sara kane's Blasted.   University of Richmond, 2008. Print.
11. http://www.communicationinterne.net/bakhtin-carnival-theory/

The Antecedents of Nonfamily Involvement in the Top Management Team

Jonathan Bauweraerts, Olivier Colot

Abstract—While a large amount of research has investigated various topics in the family business field, the study of human resource management is only emerging. With the aim of providing new insights into this problematic, the main purpose of this paper is to investigate how private family firms proceed to the appointment of the members of the top management team (TMT). Drawing on the socioemotional wealth perspective, this study examines how specific organizational factors (firm size, performance, innovation, risk-taking and proactiveness) affects the appointment of non-family members in TMT of private family firms. Based on sample of 197 Belgian private family firms, OLS and Tobit regressions are used to determine how these factors affect the appointment of nonfamily members in the TMT. The results indicate that firm size exerts a positive influence on the proportion of nonfamily members on the TMT while a negative relationship is found between firm performance and nonfamily involvement in the TMT. This article contributes to the family business and human resource literature by illustrating the conditions under which nonfamily managers become relevant for family firms.

Keywords—Family firms, Top management team, Socioemotional wealth, Human resource.

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Customer Focus in Digital Economy: Case of Russian Companies

M. Evnevich

Abstract—In modern conditions, in most markets price competition is becoming less effective. On the one hand, there is a gradual decrease in the level of marginality in main traditional sectors of the economy, so further price reduction becomes too 'expensive' for the company. On the other hand, the effect of price reduction is leveled, and the reason for this phenomenon is likely to be informational. As a result it turns out that even if the company reduces prices, making its products more accessible to the buyer, there is a high probability that this will not lead to increase in sales unless additional large-scale advertising and information campaigns are conducted. Similarly, a large-scale information and advertising campaign have a much greater effect itself than price reductions. At the same time, the cost of mass informing is growing every year, especially when using the main information channels.

The article presents generalization, systematization and development of theoretical approaches and best practices in the field of customer focus approach to business management and in the field of relationship marketing in the modern digital economy. The research methodology is based on the synthesis and content-analysis of sociological and marketing research and on the study of the systems of working with consumer appeals and loyalty programs in the 50 largest client-oriented companies in Russia. Also the analysis of internal documentation on customers' purchases in one of the largest retail companies in Russia allowed to identify if buyers prefer to buy goods for complex purchases in one retail store with the best price image for them.

The cost of attracting a new client is now quite high and continues to grow, so it becomes more important to keep him and increase the involvement through marketing tools. A huge role is played by modern digital technologies used both in advertising (emailing, SEO, contextual advertising, banner advertising, SMM, etc.) and in service. To implement the above-described client-oriented omnichannel service, it is necessary to identify the client and work with personal data provided when filling in the loyalty program application form. The analysis of loyalty programs of 50 companies identified the following types of cards: discount cards, bonus cards, mixed cards, coalition loyalty cards, bank loyalty programs, aviation loyalty programs, hybrid loyalty cards, situational loyalty cards. The use of loyalty cards allows not only to stimulate the customer to purchase 'untargeted', but also to provide individualized offers, as well as to produce more targeted information.

The development of digital technologies and modern means of communication has significantly changed not only the sphere of marketing and promotion, but also the economic landscape as a whole. Factors of competitiveness are the digital opportunities of companies in the field of customer orientation: personalization of service, customization of advertising offers, optimization of marketing activity and improvement of logistics.

Keywords—Customer focus, digital economy, loyalty program, relationship marketing.

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A Hedonic Valuation Approach to Valuing Combined Sewer Overflow Reductions

Matt S. Van Deren, Michael Papenfus

Abstract—Seattle is one of the hundreds of cities in the United States that relies on a combined sewer system to collect and convey municipal wastewater. By design, these systems convey all wastewater, including industrial and commercial wastewater, human sewage, and stormwater runoff, through a single network of pipes. Serious problems arise for combined sewer systems during heavy precipitation events when treatment plants and storage facilities are unable to accommodate the influx of wastewater needing treatment, causing the sewer system to overflow into local waterways through sewer outfalls. CSOs (Combined Sewer Overflows) pose a serious threat to human and environmental health. Principal pollutants found in CSO discharge include microbial pathogens, comprising of bacteria, viruses, parasites, oxygen-depleting substances, suspended solids, chemicals or chemical mixtures, and excess nutrients, primarily nitrogen and phosphorus. While concentrations of these pollutants can vary between overflow events, CSOs have the potential to spread disease and waterborne illnesses, contaminate drinking water supplies, disrupt aquatic life, and effect a waterbody's designated use. This paper estimates the economic impact of CSOs on residential property values. Using residential property sales data from Seattle, Washington, this paper employs a hedonic valuation model that controls for housing and neighborhood characteristics, as well as spatial and temporal effects, to predict a consumer's willingness to pay for improved water quality near their homes. Initial results indicate that a 100,000-gallon decrease in the average annual overflow discharged from a sewer outfall within 300 meters of a home is associated with a 0.053% increase in the property's sale price. For the average home in the sample, the price increase is estimated to be $18,860.23. These findings reveal some of the important economic benefits of improving water quality by reducing the frequency and severity of combined sewer overflows.

Keywords—benefits, hedonic, Seattle, sewer

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Black Protests in Poland: Analysis of Women's Movement in Poland, 2016-2018

Aneta Ostaszewska

Abstract—The purpose of this research is to reflect on 'black protests' of women in Poland. 'Black protests' have been organized nationwide since October 2016 as a sign of opposition and resistance to anti-women government's policy and its attempts to exacerbate abortion law. Women protest not only in the biggest cities (Warsaw, Cracow or Wroclaw) but in over 140 towns and villages all over Poland. The research represents qualitative methodological approach – an active research method. It has involved the observation, description, and analysis of 'black protests' carried out mainly in Warsaw (the capital of Poland). The focus has been on behavior and attitudes of protesting women: protesters' slogans, statements, and views, the ways of dressing up, ways of participating and involvement in protests. Research also involves the analysis of social media discourse: the analysis of content published by women on social media. Black protests are an example of a grassroots social initiative of women in Poland. What unites women is opposition to government policy. The primary space of communication has become the Internet – especially social media (Facebook). A new social movement 'Dziewuchy dziewuchom' (Girls for girls) has been born as well as organization of 'Ogolnopolski Strajk Kobiet' (Nationwide women's strike) as a result of 'black protest'. These protests and marches became a way of emphasizing women's subjectivity as well as political and civic activity.

Keywords—women, black protests, communitas, experience, Poland, abortion law

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Nostalgia for The 'Soviet': The Image Transformation of State Department Store of Russian Federation (GUM) in the Eyes of Women

Daria Dementeva, Margarita Chepurina, Anna Svirshchevskaya

Abstract—GUM (State Department Store of Russian Federation) appears in studies as the transfunctional object of the urban space as it has sacred and symbolic properties for Russian citizens. The GUM is now represented as museumificated shopping space with its soviet symbolism and myths, which are in turn expressed in exhibiting nostalgia for the "Soviet" by the sensemaking shaped through the Soviet art objects located in GUM. The majority of Russian researchers examine the current GUM in the context of the Soviet era and through the strategy of advertising communication with visitors. In this context, in this study we assume that the GUM is not sufficiently studied as the object in the dynamics of social processes in Russia from Soviet times to modern days. Who was the witness of the changes of GUM? Retired women can be the direct witnesses of the Soviet era; they can recall past GUM and inherent traits in Soviet times; they are able to identify similarities and differences between the modern and the Soviet GUM. Thus, it has been presumed that the variety of nostalgic experiences is the mechanism of formation and perception of the image of modern GUM through the image of Soviet GUM by the witnesses of Soviet times, retired women. Therefore, nostalgia for "the Soviet" becomes a vital guideline through which sensemaking of State Department Store of Russian Federation is either created or changed

Keywords—gendering places, nostalgia, Soviet studies, stores, transformation of images

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Economic and Social Determinants of Violence against Women: Insight from NFHS IV

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Abstract—Explaining the reasons behind violence against women is an incredibly complex attempt because violence against women receives social sanctity as well as justification from women themselves. This article attempts to examine the economic and social determinants of violence against women. In this article, two rival economic hypothesis account for the incidence of domestic violence against women in India: the Household Bargaining Model (HBM) and Male Backlash Model (MBM) are employed for a better understanding of the predictors of violence against women. The HBM postulates that when women have more resource and income generating activities they can bargain for better outcomes in the household, and they experience less violence. It follows that domestic violence is more likely to occur when women have fewer economic resources. In contrast, the MBM argues that men use violence when they feel disempowered or when they sense that the gender hierarchy is being destabilized in the household, for instance in a situation where the wife is employed while the husband is unemployed. It follows that domestic violence is more likely to occur when women have more economic resources than their husbands. Using data from National Family Health Survey-IV (NFHS-IV), the results show that economic covariates better explain the violence against women, and women are at further risk of experiencing violence when they are earning relatively higher than their husbands. Violence against women has been categorized as physical, sexual, and emotional violence and descriptive analyses revealed that 1 in four women had experienced physical violence, 1 in 8 women faced emotional violence, and 1 in 17 women have experienced sexual violence in India.

Keywords—violence against women, household bargaining model, male backlash model, physical violence

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Covariates of Women Autonomy in India

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Introduction:

In India and across the world, gender power inequities that disfavour women are widely spread. These inequities in terms of health, education, and employment opportunities as well as organizational structure inequities have been studied by many researchers [Sen & Ostlin, 2008; Hendley, A., & Charles M., 2016; Bradley, K., 2014; Collinson, D., & Hearn, J., 1996, Acker, 1990]. Girls and women are often seen as second to males [Fazio, 2004]. In some of the places across the globe, there are even restrictions on women's physical mobility, sexuality, and reproductive capacity and moreover, violence against them is justified in some of the places [Garcia et al., 2006; jejeebhoy, 1998]. Women are being treated as objects rather being treated as subjects even in their homes, and this has been time and again reflected through separate norms of behaviour and laws that disfavours them. Gender inequality is not only limited to the household level but also it can be seen at the national arena where women have less access to political power and lower participation in political institutions. While it is true that there lies gender inequality that disfavours women and favours men, but an important aspect of this inequality is that even among women there lies the differences based on caste, religion, economic status, and age. It is, in fact, has been well established that there lie the gender inequities that disfavours women as a social evil in nearly all the societies, though with different intensity in different societies. In Indian culture, social stratification is highly gendered biased. Women's status is subordinate to man in household decision making matters. This can be seen through different gender roles assigned to men and women and unequal power in decision making. The important question arises that how gender inequities can be removed from our societies and what must be the indicators to measure the autonomy. Personal autonomy can be seen as one of the most expressive indicators that give insight into women decision making power as a part of her autonomy.

Personal autonomy has been posited as a liberating force for women against these gender power inequities. Autonomy has been defined by many researchers and policy makers across the world as it has become the central part of any discussion pertaining to women welfare. Personal autonomy has been defined as the capacity to manipulate one's environment through control over resources and information for personal interests [Basu, 1999; Dyson & Moore, 1983]. After attaining personal autonomy, a woman gets direct control over certain decisions that impact her life in a positive way.

This paper aims to study the participation of women in decision making. Decision making, as already been discussed, shows that women have autonomy and they are being consulted before any major decisions. In this paper, women autonomy or women participation in decision making covers five domains namely: Health, Major purchases, Mobility, Husband earning, and contraception use. An index of autonomy has also been created with these five domains.

Women Autonomy in India:

The women in India exercise less autonomy in their own lives. This can be attributed to stronghold patriarchal values deeply embedded in Indian culture and religion. The culture in India has its say in favouring men as a husband, father, son and in any other character while disfavouring women as a wife, mother, daughter and in any other character in nearly all the societal roles and responsibilities. Banerjee and Roy [2015] in their research article stated that women autonomy in India across the states is evenly dependent on social factors and further discussed that social backwardness and religious conservativeness have reduced the potential of decision making power of women as compared to men. Women autonomy does not only liberate women herself but also the children in the household. There are various studies which confirm that women autonomy is in the larger good of the household as increase in women's autonomy will not only lead to mortality decline and improved maternal health care utilization for women herself but also improved health outcomes can be seen among their children [Caldwell, J.C., 1986; Bloom, S. S., Wypij, D., Gupta, M. D, 2001; & Mahapatro, S.R., 2012]. Self and Grabowski [2013] discussed certain economic, social, and political factors that have an impact on women's autonomy in North India. Empirical evidence from their study concluded that the availability of certain types of infrastructures along with off farm employment opportunities have a positive influence on female autonomy while political structure [Pradhan or Sarpanch at village level government] do not result in greater female autonomy when Pradhan does not have significant political experience.

There are certain factors which affect women's autonomy, and in this study, we have tried to look at those factors. Decision making power of women, no doubt, liberate women and is a well adopted measure of women's autonomy but not all the women are equally benefitted with decision making power as a tool for their autonomy. Socio-cultural background of women has a greater role in determining their autonomy so we have also studied the women's autonomy keeping in mind the various household's background characteristics.

Data and Methodology:

National Family Health Survey [NFHS] is nationally representative, multi-round, population-based survey conducted in all the states and union territories of India under the Ministry of Health and Welfare. The survey covers the wide range of fertility, infant and child mortality, maternal and child health, nutrition, reproductive health, family planning, etc. The data for this study has been taken from the fourth round [2015-16] of the survey. This study focuses only currently married women of age group 15-49 who were not pregnant.

Bivariate and multivariate techniques are used to access the association between women's participation in decision-making and various socio-demographic indicators. Binary logistic regression analysis is used to obtain odds of different type of decision making indicator among women. The dependent variables are five indicators, the decision regarding own health care, major household purchase, visit to women's family or relative, husband earning, and contraception use. One composite index of women autonomy is constructed based on above four question except question for contraception use and one extra question has been included which is about how a woman use the money she has with her. The decision regarding contraception use is not included in the index because of depressed sample size. All the five questions have been coded in two categories [1= if women alone or jointly decide, 0= if women have no role in decision making]. Further index is divided into two categories for logistic analysis. Index value 0 to 3 is clubbed together in "low autonomy" group and value 4-5 in "high autonomy" group. Binary Logistic regression is applied separately on five decision-making indicator and women autonomy indicator. The independent variables are age, place of residence, working status, no of living children, wealth index, and education.

Let Y_i is the independent variable; X_i is the set of explanatory variables and β_i is the coefficient, then logistic regression equation is

$$logit(P) = \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots$$

Where P is predicted the probability and log odd of P and [1–P] provides the odds ratios on the reference category.

Various dimensions of decision making are treated as a dependent variable determined by a combination of socio-economic factors of the married women. Index of women autonomy has also been compiled from some crucial aspects of women's decision making: mobility, large household purchases, contraception use, own health care, and decision on husband's earnings. This index is compiled as sum of scores on each of the constituent variables where 1 determine the respondent herself could decide or take decision whereas 0 signifies that respondent does not have any saying in decision making. The five important domain of decision making are:

1. Own Health Care: This dimension of decision making signifies that whether the respondent alone or with her husband can take a decision regarding her own health care or someone else in the household is making decisions regarding her health care.

2. Mobility: It measures whether the women alone or along with her husband can decide to go to meet her family or relatives or someone else in the household manages her mobility.

3. Decision to utilise money she has: It measures that whether a woman alone or with her husband can decide to use the money she has or not.

4. Major Household's Purchases: whether the respondent is the major decision maker about major household purchases or not.

5. Husband's earning: This aspect of decision making measures that whether a woman has any decision to make on how to spend the money earned by her husband or not.

A six category scale of the extent of decision making a woman have by counting how many of the five possible dimensions of decision making is also constructed.

Result:

Table 1 shows the percentage of women who reported that they take specific household decision either alone or with their husband. Decision making has been captured through five different domains, and the results of crosstab show the significant association between the decision-making and the background characteristic of women. Women participation [either alone or with husband] is highest in deciding the contraception use [91.6%] followed by the decision taken regarding their own health care [75%], visit to her family or relatives [75.1%], major household purchase [74%], and husband's earning [71.2%]. The results clearly indicate that women's say in her husband earning is least among all the covariates of decision making implying the upper hand a husband has in economic decisions of the households.

Nearly 60 percent of ever-married women of age 15 to 19 take decisions related to their own health alone or with their husband, and there is variation within the age group. The percentage of women who took a decision regarding their own health care goes on increasing from 60 percent in the age group 15-19 to 79 percent in the age group 45-59 signifying the value given to the women with the increase in age. It can be understood with the fact of maturity as when women get maturity; she starts getting her say in the decision regarding her health care. A similar trend can be seen for other decision making domains also excluding contraception use where it is nearly stagnant between 91 to 92 percent. Their participation in own health care decision-making and visit to her family or relatives gradually increases with the increase in their age, education, and income. It suggests that education, income, and increase in age has a positive association with women autonomy. Major household purchases are one of the important dimensions where autonomy means a lot. Purchasing autonomy is greater among urban married women [77.2%] than in rural married women [72.3%] for the obvious reason of urban women being more educated, economic stable and independent. Working status of women has been positively associated with all the dimensions of women autonomy implies that working women will have higher autonomy than non-working women.

Mobility can be seen as one of the most prominent measures of autonomy in a woman's life. Mobility does not only means visit to family or relative but also encompasses daily mobility as can be seen as going out to the temple, shop for daily purchases, and to other places as per own convenience. Though in this study because of data limitations mobility autonomy is captured through the visit of a woman to her family or relatives only. Mobility autonomy among women can be a predictor of better outcomes related to health and education and thus influences better health facilities and better education among children in households. Women residing in urban areas have higher mobility autonomy than their counterparts. Nearly 67 percent of those married women who have zero living children have mobility autonomy which increases to 76.6 % when they have one living children and again decreases with the increase in living children. This trend in mobility autonomy with the number of living children a woman has signifies that when women have either zero or one living child than they are not very much pre occupied with their children and have enough time for themselves to visit family and relatives, but once when the number of children increases the women becomes busy and occupied with their children and this may be one of the reasons for lesser mobility autonomy.

With a higher number of living children women's autonomy increases in decisions related to husband earnings but with the increase in a number of living children the women's autonomy in deciding contraception use decreases which is an eye opener finding. Ideally, after having one child women's say in contraception use shall increase but in the result, it is decreased which may possibly be attributed to the desire of son, but nothing can be concluded significantly as the variations are not striking.

The results in table 1 can be quite misleading when considering the decision making autonomy women have along with her husband. Results in table 1 encapsulated husband's saying also in women's decision thus invading the overall effectiveness of women's autonomy. So in next two table, i.e., Table 2 and 3, results are the outcome of only women's decision making power. Table 2 also shows the percentage of different decision makers. Clearly, it can be seen that women have very less decision making power for all the covariates of autonomy.

In table 2, women autonomy has been captured through a different lens, and that gives a glimpse of a gloomy picture of women's autonomy in India. Only 12 percent of women have the autonomy to take decisions about their health care without taking any consent from anyone. Only 9 percent of the married women have mobility autonomy, and nearly 8 percent of the married women have sole authority over decisions regarding contraception use and major household's purchases. Another facet is about those women who are head of their respective households, such women are the sole authority in their household, and thus these women need to be separated from our analysis. They are already empowered and able to take decision for themselves as well as for others. The results present unwelcoming scenario when only those women are taken for analysis who are not the head of the households. In such situation, only 7 percent of the married women have autonomy in major household's purchases and in meeting family and relatives. Women's control over their own earning is also less but compared to other dimensions it is quite better. Only 2 out of 10 women can decide independently how to use their own earning while 26 percent of the husband are the primary decision makers about their own earnings. Nearly 7 percent of the married women have sole authority over their husband's earning while approximatly 17 percent of the husbands have independent decision making power over their wife's earning which shows men in clear dominating position. Some of the decisions gives best results when taken jointly with women and her partner like contraception use and major household purchases and it is reflected from the result where for contraception use 83 percent of women are taking decision with their partner while for major household's purchases nearly 66 percent of women are taking decisions with their partner.

Table 3 shows the detailed analysis of married women who are the sole authority in decision making. Women's decision making ascendancy varies with a change in their characteristics. Younger women are least accord with solitory decision making authority. Around 4 percent of married women in the age group 15-19 have sole decision making authority over major household's decision while nearly 11 percent of women in age group 45-49 can take independently decision regarding major households purchase. The results indicate that work status of women acts as a facilitator in their sole decision making authority. With the increase in educational status of women, the sole decision making authority among women decreases as more number of women with lesser education have sole authority over decision making. This can be understood as when a girl gets married then she is more likely to be married off to a person who is usually at a higher position than her and hence the sole decision making authority among these women is low. Women's health is a prime agenda in every development

goal, and most of the government around the world would agree upon this, but still, women's autonomy upon own health care needs a critical look. It is such a disturbing figure that nearly 92 percent of women in the age group 15-19 cannot decide for their own health care without discussing /asking their husband or others in the family. Around 8-12 percent of the women in age group 15-34 have the solitary authority on decision making regarding their own health care. Women in the 15-34 age group are more critical from decision -making point of view regarding their own health care because women in this age group go through their reproductive span in India and thus need more autonomy in own health care.

Table 4 indicates the association between the decisions of married women on their own health, major household purchase, visit to her family/relatives, husband earning, and contraception with selected background characteristic. The odds of taking the decision regarding their own health is 2.4 times more in the women of age group 45-49 as compared to the women in the age group 15-19. Age of the married women has the profound effect on all the five dimension of the decision-making. Women of higher age group [age 35 and above] have nearly 2 times more say in health care, mobility to meet family/relative, and economic decision [major household purchase and husband's earning] compared to the women of early age group [15-19]. Wealth index does not have any significant relationship with the decision on health care whereas women's education plays an imperative role in her decision making regarding her health care. Women with higher education have 2 times more say in own health care, in the major household purchase, and in a visit to her family/relative, compared to the uneducated women's. Women's employment shows a significant relationship with four out of five covariates of women's autonomy. Women, who work for cash are more likely to participate in own health-care decision-making, major household purchases, visit her family or relatives, and in the decision on husband's earning. Place of residence does not have any significant relationship with any of the covariates of women's autonomy. The number of living children also plays a significant role in women's decision-making power. The odds of participating in own health-care decision is 1.26, 1.21 and 1.16 times higher in women with one, two and 3 or more living children respectively compared to those women who do not have any living children. It is also significantly associated with the women's say on the major household purchase, and husband's earning. The odds of participating in the decision on husbands earning is 1.21 times more in women with any number of living children compared to those who do not have any living children. The influence of women in decisions does not vary significantly over the different wealth quintile except the decision on contraception.

Figure 1 shows the extent of decision making a woman have among the five possible dimensions of decision making. The result shows that nearly 10 percent of the women do not have any saying in decision making on any of the five dimensions of autonomy whereas nearly 29 percent of women have decision-making in all the five dimensions of autonomy. More than one third of the women take decisions on any of the four dimensions of autonomy either alone or along with their husbands.

Fig. 1: Percent distribution of women who reported to have autonomy in number of different dimensions
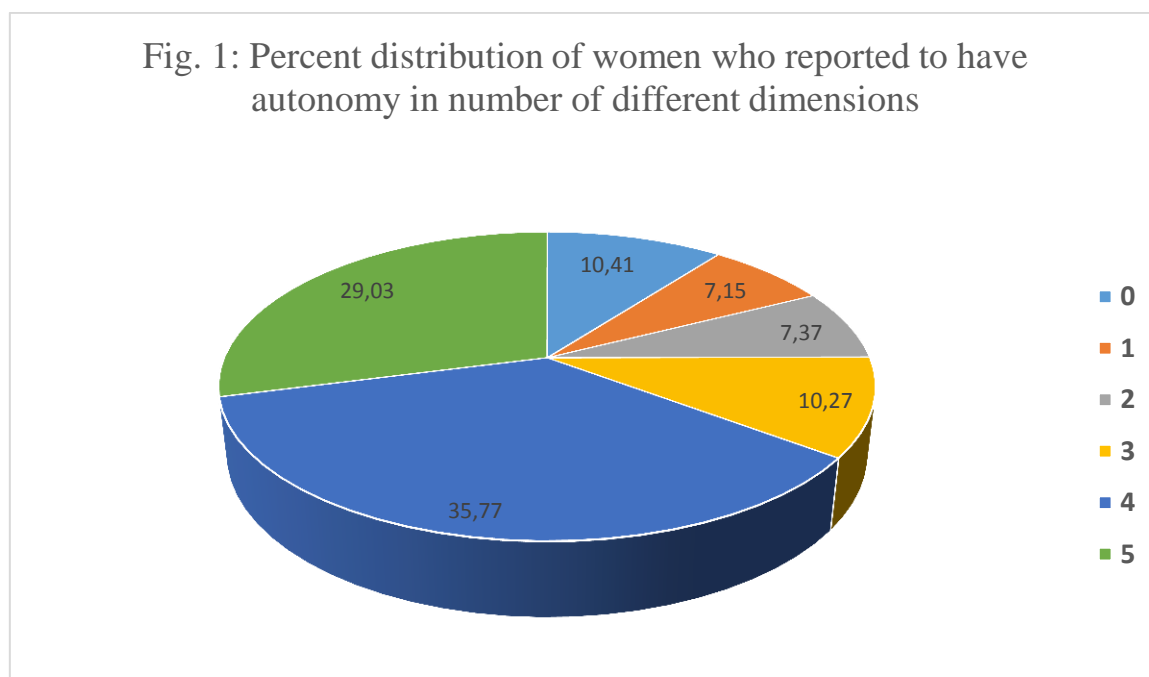
Table 5 shows the result of logistic regression between women autonomy index and different socio-demographic variable. Women autonomy index has been created by adding up all the five dimensions of decision making. Age of married women is a significant correlate of women autonomy. The probability that women of age 35 and above will enjoy high autonomy is 99% or more as compared to the women of age group 15-19. The odds of having autonomy is higher among urban married women than rural women. Women in urban areas are 12 percent more likely to have autonomy than women in rural areas. Working status is also one of the facilitators of rising autonomy among married women. The odds of having autonomy increases by 1.41 times among those women who are working as compared to their counterparts. Education can be seen as one of the most important catalysts in achieving autonomy. Women with higher education are nearly two times more likely to have higher autonomy than illiterate women. The result does not show any association between wealth accumulation and

autonomy and hence wealth is not necessarily a means to achieve a greater female autonomy as it has an ambivalent influence on women's autonomy. Number of living children to an extent affects the women autonomy since women without children have less autonomy than those women who have living children.

Conclusion & Discussion:

The paper aims at capturing the women's autonomy in five critical dimensions. Although women autonomy [decision making either alone or with husband] has increased significantly, the findings suggest that gender dynamics and male involvement is still very much valued in the women's decision making. Still, the situation of women's autonomy in the country is not very promising. A major saying in the decision still lies with husband and women just act as a sub ordinate to their husband. The power to decide alone among women is very important for overall development of the household, and it only rises when husband consent is made mandatory along with the women's consent. It signifies the deep rooted gender power relations which are embedded in Indian culture since long. With husband playing an imperative role in all the decision making, the participation of women in such decisions is highly questionable. The decision making power of women alone ranges between 6 to 11 percent for all the dimensions of decision making which is otherwise ranging between 70-80 percent when husband is involved in decision making signifying the upper hand a husband has in decision making. The study reiterate that men are the primary decision makers in the household for all the five dimensions so there is need to assess the impact of educating these men so that they can bring in the positive changes in the household in terms of improved health outcomes, better education for their children, and for overall development of the family.

The findings, as measured by solo decision making power of women, imply that there is still need to focus on policies that may help women in achieving higher autonomy. Though it can be debated that how far solo decision making authority of women is better than the joint decision making authority of women along with men, there are certain dimensions where women need to have higher solo decision making power like the dimension of own health care, mobility, and daily household purchases. Joint decision making authority, per se, is desirable when considering big budget household purchases, children's education, and overall health care utilisation of members of the family. Joint decision can also be a boon in case when negative consequences occur as a result of such decision then the blame can be shared between both the partners albeit as in solo decision where women may be empowered to take decision but also have to bear the full burden of the failure of any decision and as a result of this women may crumble against the pressure and responsibilities. India being a male headed society, the solo decision making power may also boomerang the women where women's sole authority of decision making can be viewed by her husband as a threat to his household head status. Solo decision making powers among women in India may also come with some sort of negative consequences as in the Phillipines where solo decision making authority of women has been associated with increased inter-partner violence [Hindin & Adair, 2002]. It is not only the solo decision making authority of women that invites the wrath upon her but also lack of decision making power did the same to women and in the much severe way. Rao [1997] in one of the studies conducted in South India, stated that women suffering as a victim of physical violence increased when they have less control over household decisions.

The study clearly showed that women autonomy as measured with decision making authority is quite low when considering decisions taken alone by women and this need to be assessed in future studies.

References:

Basu, A. M. [1999]. Fertility decline and increasing gender imbalance in India, including a possible South Indian turnaround. *Development and Change*, *30*[2], 237-263.

Dyson, T., & Moore, M. [1983]. On kinship structure, female autonomy, and demographic behavior in India. *Population and development review*, 35-60.

Sen, G., & Östlin, P. [2008]. Gender inequity in health: why it exists and how we can change it.

Fazio, I. [2004]. The family, honour and gender in Sicily: models and new research. *Modern Italy*, *9*[2], 263-280.

Garcia-Moreno, C., Jansen, H. A., Ellsberg, M., Heise, L., & Watts, C. H. [2006]. Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *The lancet*, *368*[9543], 1260-1269.

Hendley, A., & Charles, M. [2016]. Gender Inequality in Education. *The Wiley Blackwell Encyclopedia of Gender and Sexuality Studies*.

Bradley, K. [2014]. Gender Inequality in Education. *Education and sociology: An encyclopedia*, 295.

Collinson, D., & Hearn, J. [Eds.]. [1996]. *Men as managers, managers as men: Critical perspectives on men, masculinities and managements*. Sage.

Acker, J. [1990]. Hierarchies, jobs, bodies: A theory of gendered organizations. *Gender & society*, *4*[2], 139-158.

Jejeebhoy, S. J. [1998]. Wife-beating in rural India: a husband's right? Evidence from survey data. *Economic and Political weekly*, 855-862.

Banerjee, S., & Roy, A. [2015]. Determinants of Female Autonomy across Indian States. *Journal of Economics, Business and Management*, *3*[11].

Self, S., & Grabowski, R. [2013]. Female Autonomy in Rural North India: Impact of Economic, Social, and Political Factors. *Journal of Economic Development*, *38*[1], 59.

Mahapatro, S. R. [2012]. Utilization of maternal and child health care services in India: Does women's autonomy matter?. *The Journal of Family Welfare*, vol. 58, no. 1, pp. 22-33.

Caldwell, J. C. [1986]. Routes to low mortality in poor countries. *Population and development review*, 171-220.

Bloom, S. S., Wypij, D., & Gupta, M. D. [2001]. Dimensions of women's autonomy and the influence on maternal health care utilization in a north Indian city. *Demography*, *38*[1], 67-78.

Hindin, M. J., & Adair, L. S. [2002]. Who's at risk? Factors associated with intimate partner violence in the Philippines. *Social Science & Medicine*, *55*[8], 1385-1399.

Rao, V. [1997]. Wife-beating in rural South India: A qualitative and econometric analysis. *Social science & medicine*, *44*[8], 1169-1180.

Table 1: Percentage of women's participation in decision making

Background characteristic	Own Health	Major household purchase	Visit to her family or relatives	Decision on Husband Earning	Final Decision on contraception
Age					
15-19	60.3	55.4	58.9	54.4	90.1
20-24	68.9	65.7	68.1	65.1	91.1
25-29	72.9	71.7	72.4	68.7	92
30-34	76	74.6	75.5	72.3	91.6
35-39	77.5	77.5	79	74.1	91.6
40-44	78.3	79.1	79.1	75.1	91.8
45-49	79.1	78.8	79.7	74.7	91.4
Place of residence					
Rural	74.1	72.3	73.2	70.3	92.7
Urban	76.6	77.2	78.7	72.7	91
Working status					
Yes	79.7	78.6	79.5	77.2	91.8
No	73.4	72.5	73.3	69.2	91.6
No. Of living children					
0	67.2	63.7	67.1	63.1	90.3
1	75.9	75.1	76.6	71.5	92.2
2	75.4	74.8	75.2	72.3	91
3+	74.9	73.7	72.7	72.8	89.9
Wealth index					
Poorest	72.6	70.9	70.4	69.9	88.9
Poorer	73.2	72.4	72.4	69.9	90.4
Middle	73.8	72.6	73.9	69.7	91.3
Richer	75.3	75	77.1	71.5	92.4
Richest	78.8	77.8	80	74.1	93.8
Education					
No education	72.5	72	71.4	70.1	89.5
Primary	74.3	74	74.7	70.3	91.5
Secondary	75.2	73.8	76	70.9	92.6
Higher	82.3	80.8	83.2	76.9	95.1
Total	75	74	75.1	71.2	91.6

Table 2: Percentage distribution of decision maker

	Alone			With Husband/Partner	Partner alone	Others
	Head	Not head	Total			
Own Health Care	1.7	10.5	12.2	62.8	22.4	2.7
Meet family/relative	1.2	7.3	8.5	66.6	21	3.9
Respondent own earning	2.7	18	20.7	61.5	16.7	1.1
Contraception	0.4	7.8	8.2	83.4	8.3	0.1
Major Purchase	1.2	7	8.2	65.8	21.2	4.8
Husband earning	1.1	6.2	7.3	63	26.4	3.4

Table3: Percentage of women who takes decision independently by socio-background characteristics.

Background characteristic		Own Health	Major household purchase	Visit to her family or relatives	Decision on Husband Earning	Final Decision on contraception
Age						
15-19		7.6	3.8	5.2	3.8	7.4
20-24		8.6	4.4	4.8	4.6	7.1
25-29		10.9	6.8	6.8	6.3	7.3
30-34		12.2	8	9	7.1	7.9
35-39		13.8	9.5	9.8	8.6	8.8
40-44		13.7	10.6	10.2	8.5	8.6
45-49		14.9	11.1	11.2	9.3	9.5
Place of residence						
Rural		11.6	7.4	7.8	6.7	8.1
Urban		13.3	9.6	9.8	8.4	8.4
Working status						
Yes		16.8	11.7	11.9	10.1	8.7
No		10.7	7	7.4	6.3	8.3
No of living children						
	0	9.4	5.9	6.7	5.6	6.2
	1	11.4	7.1	8.2	6	7.7
	2	12.6	9.2	8.8	7.5	7.5
	3	12.9	8.2	8.7	8	9.2
Wealth index						
Poorest		11.3	6.8	7.6	7.1	9
Poorer		12.2	7.6	8.1	7.1	8.6
Middle		12.6	9	8.3	7.9	8.4
Richer		12.3	9.3	9.1	7.8	8.1
Richest		12.4	8	9	6.3	7.4
Education						
No education		12.2	8.8	8.5	8	9
Primary		13	8.8	8.5	8.1	8.5
Secondary		11.9	7.8	8.3	6.8	7.8
Higher		12.6	7.6	9.4	5.7	7.1

Table 4: Bivariate analysis of women's participation and socio-background characteristic

Socio-Demographic Characteristics	On Own Health	Major Household Purchase	Visit to her family or relatives	Decision on Husband Earning	Final Decision on Contraception
Age					
15-19®					
20-24	1.29**	1.33**	1.31**	1.41**	1.27
25-29	1.51**	1.71**	1.59**	1.58**	1.56**
30-34	1.81**	2**	1.92**	1.88**	1.53**
35-39	2.03**	2.44**	2.46**	2.08**	1.58**
40-44	2.2**	2.78**	2.59**	2.23**	1.75**
45-49	2.41**	2.84**	2.83**	2.25**	1.13**
Place of residence					
Rural®					
Urban	1	0.85**	0.88**	0.97	1.12**
Education level					
No education®					
Primary Education	1.19**	1.19**	1.26**	1.09**	1.19**
Secondary	1.38**	1.31**	1.46**	1.24**	1.28**
Higher	2.06**	1.9**	2.18**	1.66**	1.8**
Working Status					
No®					
Yes	1.39**	1.33**	1.35**	1.46**	1.07
Wealth Index					
Poorest®					
Poorer	0.96	1	1	0.96	1.07
Middle	0.93*	0.93**	0.98	0.91**	1.29**
Richer	0.94*	0.93*	1.03	0.93*	1.29**
Richest	0.98	0.91**	1	0.96	1.62**
No of living Children					
0®					
1	1.26**	1.33**	1.26**	1.21	1.17
2	1.21**	1.23**	1.14**	1.21	1.14
3	1.16**	1.11*	1	1.21	1.26
Constant	1.06	1.01	1.022	0.96	3.72

*** indicates significance at 1% and * indicates significance at 5 % and level of confidence.*
® indicates refernce category

Table 5: Result of logistic Regression of Women Autonomy Index with socio-economic background characteristics

Socio-Demographic Characteristic	Odds Ratio	Lower Bound	Upper Bound
Age			
15-19®			
20-24	1.22**	1.11	1.35
25-29	1.47**	1.33	1.62
30-34	1.76**	1.59	1.95
35-39	1.99**	1.79	2.21
40-44	2.21**	1.99	2.45
45-49	2.27**	2.04	2.52
Place of residence			
Rural®			
Urban	1.12**	1.08	1.16
Education level			
No education®			
Primary Education	1.24**	1.18	1.3
Secondary	1.43**	1.37	1.49
Higher	2.08**	1.94	2.23
Working Status			
No®			
Yes	1.41**	1.36	1.46
Wealth Index			
Poorest®			
Poorer	1	0.96	1.05
Middle	0.97	0.93	1.02
Richer	0.96	0.91	1.01
Richest	1.01	0.95	1.07
No of living Children			
0®			
1	1.32**	1.23	1.4
2	1.29**	1.22	1.38
3+	1.28**	1.2	1.37
Constant	0.62		

*** indicates significance at 1% and * * indicates significance at 5 % and level of confidence.*
® indicates refernce category

Gender Relations and Domestic Violence in Sub-Saharan Africa: An Analysis of Socio-Economic and Socio-Cultural Determinants in Cameroon and Burkina Faso

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Abstract

"The general objective of this study is to contribute to the improvement of knowledge on factors that could explain the high level of physical violence on women in Cameroon and Burkina Faso. We used data from the 2011 Demographic and Health Surveys (DHS) of Burkina Faso and Cameroon. Our analyses which is based on the uni-variate probit model shows that the probability for a woman to physically violated in household is high when she comes from a poor household and she is not economically occupied (have not access to labor market).

INTRODUCTION

One-third of women around the world have already been beaten, coerced into sex or otherwise abused; most often violence is perpetrated by their husbands or other male family members (UNFPA, 2000). WHO estimates that millions of African women are victims of domestic violence, 41.6% in sub-Saharan Africa, 65.5% in Central Africa and 41.8% in West Africa. Such violence has negative consequences for the victims.

According to data from the fourth Cameroon Demographic Health Survey, 29% of respondents reported having been physically abused by their intimate partner during 12 years preceding the survey. Moreover, in West Africa, Burkina Faso has a lower rate (11%) according to the fourth Multiple Indicator Demographic Health Survey conducted in 2010.

In view of the above figures, it should be noted that physical domestic violence thus exists in Cameroon and Burkina Faso, with a gap of 18% between the two countries. Why this gap? The gender relations that exist in these societies can be the causes. Several empirical studies have shown that the gender relations that exist in a couple are at the origin of domestic violence. Indeed, according to Gastineau (2007) violence occurs in a relationship when the age gap between a couple is very large especially when the woman is older than her spouse. Moreover, in a homogeneous couple with a low level of education, women suffer physical violence. It should be noted that decision-making in the couple, the couple's income and the control of the spouse are factors that influence the occurrence of physical domestic violence.

Thus, this study raises the following question:

1) What are the factors that cause physical domestic violence in Cameroon and Burkina Faso?

2) Can this gap be explained by gender relations?

The specific objectives of this study are stipulated as follows:

(i) To demonstrate that domestic violence in a couple in Cameroon and Burkina Faso is impacted by gender relations.

(ii) To determine the relationship between domestic violence and the socio-economic and socio-cultural characteristics of couples.

This study made used of data from the fourth Demographic Health Surveys conducted in Cameroon and Burkina Faso in 2011 and 2010 respectively. The analysis is done first with descriptive analysis using Chi-square and then with explanatory analysis using binomial logistic regression.

This work is divided into three main parts: the theoretical framework; methodology; and the results.

I- Theoretical framework

1.1 Manifestation of violence

Violence can be practiced in both public and private spheres. Domestic violence is the most common form of violence against women. This type of violence stems from societal norms. In a public environment, violence takes place either in professional settings, schools or on the streets.

Gender-based violence generally includes harassment, rape, incest, female genital mutilation, trafficking and widowhood rites.

Finally, institutional violence is discriminatory legislation, discriminatory practices and economic and domestic violence.

1.2 Gender approach

According to **Tola**, (2000) "gender theory is a conceptual framework that serves to analyse the social relations that govern relations between men and women by integrating their differences, complementarities and synergies. The gender approach is a new theoretical construction of social sex relations. It constitutes a critical break with sociology that has long ignored them.

Empirical studies have highlighted the influence of gender-related variables on violence. These include: characteristics of the couple (age gap between spouses, length of union, difference in educational level of spouses, difference in income of spouses) and variables related to decision-making.

1.2.1. couple characteristics

According to some studies, the age gap is associated with the prevalence of domestic violence. Empirical studies have shown that in most cases, there is a consistent relationship between the age gap and domestic violence when the woman is older than the man (KISHOR et al.; 2006).

Women who are better educated are the most beaten by their husband. This is the case of a study in Madagascar where 40.6% of women whose couple is homogenous have a low level of education (ELVICA, 2007).

When the husband holds economic power and has a higher income than the woman violence is lower. Thus, when a woman's income is higher than or equal to that of her husband, 34% of women report having been victims of violence, compared to 48% for those who have an income lower than that of their spouses (Gastineau et al., 2009).

1.2.2 Decision Making

Household decision-making has been identified as a precursor to partner violence (Levinson, 1989). Some studies have shown that violence persists in couples where the man or woman decides alone (MC CLOSKEY et al.,2005) show that rates of spousal violence tend to be lower among couples who make joint decisions at the household level than among those in household where only the husband, or wife alone, makes the decisions.

II Study hypothesis

H1: The influence of gender relations in the couple on physical domestic violence depends on the educational level of the spouses. In the same context, women who are better educated than their partners are more likely than others to experience physical domestic violence.

H2: Couples in which women are older deviate from the norms. Women in relationships whose age gap between with their spouse is less than or equal to 2 years are more likely to be victims of physical domestic violence than others.

H3: Poverty causes some men stress, exasperation and a feeling of mediocrity because they feel they are not up to the role of provider culture imposes on them. this can be the starting point for marital disagreements. The influence of gender relations on physical domestic violence varies according to the couple's income. Indeed, women with higher incomes than their spouses are the ones who suffer the majority of violence.

III DATA AND METHOD

3.1 Data Sources

The study on domestic violence in sub-Saharan Africa is of particular scientific, social and political interest. In Burkina Faso and Cameroon, the sources that allow us to capture this phenomenon are generally Demographic and Health Surveys (DHS), MICS and data from the Ministry of the Family and the Ministry of Women's empowerment and the family. For the

purposes of this study, the data used are those from the Burkina Faso and Cameroon DHSs conducted in 2010 and 2011 respectively.

3.2 Target group: Women in union (married or living with a partner) aged 15-49.

3.3 Study Variables

3.3.1 The dependent variable "violence

It is a dichotomous variable whose modalities are: "1: the woman has suffered violence"; 0: the woman has not suffered violence". It captures the extent to which a woman has been subjected to domestic violence in the past 12 months.

Construction of the "violence" variable

Several variables were combined in the generation of our dependent variable. These variables are derived from a number of questions that were asked of women during data collection:

1. Have you been beaten by your spouse for going out unannounced? Yes- No

2. Have you been beaten by your spouse for neglecting your children? Yes- No

3. Have you been beaten by your spouse for refusing to have sex with him? Yes- No

4 Were you beaten by your spouse for burning the meal in the fire? Yes- No

5 Have you ever been threatened with a weapon by your husband or partner? Yes- No

6 were you ever pushed by your partner husband? Yes- No

7 Have you ever been threatened with a knife or cup cutter by your husband or partner? Yes- No

Any woman who answered "YES" to any of the above questions is presumed to have suffered domestic violence.

Independent variables:

Place of residence

Region

Educational level of the couple

Income of the couple

Age difference of the couple

Household standard of living

Women's work

3.4 Explanatory Analysis Methodology: Specification of the uni-variate probit econometric model

Domestic violence in the African context, particularly in sub-Saharan countries, is a complex phenomenon to explain, as it's sociological and contextual foundations are sometimes difficult to understand. Nevertheless, there are several econometric methods for determining domestic violence. These methods include logit or variable uni probit. This method therefore assumes domestic violence is an isolated phenomenon. In the case of this study, we took into account violence or not on the woman in the household with two modalities 1"YES" and 0"NO". Given the qualitative nature of our dependent variable, the probit regression method is perfectly adapted. It tests a woman's likelihood of being physically abused by her husband/partner.

The model is written as follows:

(1) VIOLENCE* = $X\alpha$ + v; with VIOLENCE =1 if VIOLENCE* >0 and VIOLENCE=0 otherwise

- VIOLENCE*" is a variable that expresses a woman's ability to be physically violated.

"VIOLENCE*" is not observed. On the other hand, "VIOLENCE" is observed and measures a woman's propensity to be subjected to domestic violence. "VIOLENCE" takes the value 1 if the woman is subject to it and 0 otherwise;

- X denotes the set of independent variables;

- ν is the set of normally distributed error terms, i.e. E(v)=1 and

IV Results

Summary table of regression coefficients.

Variables	BURKINA FASO		CAMEROUN	
	Coefficient α (violence = 1)	Marginal effet dx/dy	Coefficient β (violence = 1)	Marginal effet dx/dy
TYPE OF PLACE OF RESIDENCE				
Urban	-0.02ns	-0.00ns	0.02ns	0.00ns
Rural	Réf	réf	réf	réf
STANDARD OF LIVING				
Poor	0.16***	0.05**	0.08ns	0.02ns
Middle	0.07ns	0.02ns	0.14**	0.03**
Rich	Réf	réf	réf	réf
WOMEN WORKING				
yes	Réf	réf	réf	réf
No	-0.07ns	-0.02ns	0.18**	0.04**
COUPLE INCOME				
Woman earn more	-0.16*	-0.04*	0.03ns	0.00ns
husband earn more	Réf	réf	réf	réf
Same income	0.03ns	0.00ns	0.00ns	0.00ns
COUPLE LEVEL OF EDUCATION				
Woman more educated	0.02ns	0.02ns	0.00ns	0.00ns
Same level	Réf	réf	réf	réf
husband more educated	0.05ns	0.00ns	0.00ns	0.00ns
AGE OF COUPLE				
Older woman	-0.17ns	-0.04ns	-0.13ns	0.02ns
Same age	0.00ns	0.00ns	0.00ns	0.00ns
Older husband	Réf	réf	réf	réf
REGION				
Boucle de Bouhoun	-0.05ns	-0.01ns		
Cascade	0.00ns	0.00ns		
Centre	-0.17*	-0.05**		
Centre –East	-0.21*	-0.05**		
Centre-North	-0.36***	-0.08***		
Centre-West	Réf	réf		
Centre-South	-0.67***	-0.14***		
East	-0.87***	-0.17***		
Haut bassins	-0.19**	-0.05**		
North	-0.05ns	-0.01ns		
Plateau Central	-0.38***	-0.09***		
Sahel	-0.20***	-0.05**		
South-west	0.02ns	0.00ns		
Adamaoua			-0.21**	-0.04***
Center			0.00ns	-0.02ns
Douala			0.08ns	0.01ns
East			-0.18*	-0.04**
Extrême North			réf	réf
Littoral			0.15ns	0.03ns
North			-0.08ns	-0.01ns
North-west			0.07ns	0.01ns
west			-0.02ns	0.00ns
South			0.25***	0.06**
south-west			0.05ns	0.01ns
Yaounde			-0.02ns	0.00ns
Signif. codes: 0 '***' ; 0.05 '**' ; '*' 0.1 Ns : non significant				

- **Contextual impact of physical violence on housewives in Burkina Faso and Cameroon**

The results of our econometric model Probit show us that at the explanatory level, the place of residence is not significant whatever the degree of significance considered in our two countries of study. This variable therefore does not influence the couple's behaviour regarding violence against women, either in Burkina Faso or Cameroon. In other words, whether the couple resides in rural or urban areas, women are at equal risk of physical abuse by their husbands or partners.

However, the analysis is different for the region in which couples live. In Burkina Faso, for example, the region of residence has a very significant influence on couples' behaviour in the face of violence. For example, at the 1% threshold, women living in the South Central, East Central and Central Plateau regions are respectively 14%, 17% and 9% less likely to experience spousal violence compared to their counterparts in the West Central region. At 5% degree of significance, those living in the Central, Central-Eastern, Upper Basin and Sahel regions are 5% less likely to experience violence compared to their counterparts in the Central-West. Taking into account the regions in Burkina Faso, there is a significant difference in the behaviour of spouses with regard to the violence they inflict on their wives or female partners.

Moreover, in Cameroon, the regional analysis seems to have less influence on the behaviour of spouses in the face of domestic violence. Thus, analysis in all regions shows that women are at the same risk of physical violence at the hands of their husband or male partners in the vast majority of regions except Adamaoua and East where women living in these regions are 4% less likely to be physically abused than in other regions.

- **Sociocultural impact of physical violence on housewives in Burkina Faso and Cameroon**

The results of our analyses show us that educational level of the couple does not significantly influence violence against women in the home in our two countries of study. Thus, we realize that neither hypogamy, nor homogamy nor hypergamy determines the husband's/partner's behaviour in the face of violence against women in Burkina Faso and Cameroon. In other words, whatever the degree of significance, whether the wife is more educated than her husband/partner, whether the husband is better educated or both have the same level of education; women are at the same risk of violence from their husbands in Burkina Faso and Cameroon.

The analysis is identical with the age difference between husband and wife. We note in the results that the age of the couple is not significantly associated with the explanation of physical violence against women. Thus women are exposed to the same risk of violence in Cameroonian and Burkinabe households even if the latter are older than their husbands or husbands.

- **Socio-economic impact of physical violence on housewives in Burkina Faso and Cameroon**

The standard of living is a determining factor in explaining violence in sub-Saharan Africa. Thus, depending on whether the household is poor or rich, there is a difference in the behaviour of husbands/male partners towards their wives. Thus, the results of our analyses show us that in Burkina Faso, at the 1% significance threshold, women living in poor households run a 5% higher risk than their counterparts living in rich households. Thus, the lower the household standard of living, the higher the risk of physical violence against women in Burkina Faso. This analysis is identical in Cameroon where we note that at the 5% significance threshold, women living in households characterized by an average standard of living run a 3% higher risk of being physically abused by their husbands/Partners than those living in rich households. The standard of living is thus revealed as a main factor in explaining the occurrence of violence against women by their partners in both countries.

The couple's income does not influence their behaviour or the risk of domestic violence in Cameroon. Thus the results show us that whatever the degree of significance, the fact that women earn more than men, the fact that men earn more or even the fact that both are on an equal income does not affect the existential risk that women will be beaten or suffer any physical violence. Thus women, regardless of their income compared to that of their husbands, are subject to the same risk of violence by their spouses in Cameroon. However, in Burkina Faso, analyses reveal that at the 5% threshold, women who earn more than their husbands are 4% less likely to be abused by their husbands/partners than those who have husbands who have higher incomes. This is therefore a differentiating factor between Cameroon and Burkina Faso

Finally, economic occupation also plays a role in explaining domestic violence in Cameroon, unlike the situation in Burkina Faso. Thus, at the 5% threshold, women's occupation is significantly associated with violence in Cameroon. Women who do not work are 4% more likely to be beaten or physically abused by their spouses than their counterparts who are employed. On the other hand, in Burkina Faso, whether women work or not, there is no significant difference in their exposure to the risk of domestic violence.

CONCLUSION

Long treated as a private problem within the family, domestic violence is nowadays considered a serious human rights violation that must be punished (United Nations General Assembly, 1991). Similarly, the International Conference on Population and Development (Cairo, 1994) and the International Women's Conference (Beijing, 1995) included in their respective Plans of Action objectives to eliminate this type of violence in the world.

At the end of our analyses, we note that there are several common variables between Burkina Faso and Cameroon that determine the occurrence of violence against women in households. These are mainly the educational level of the couple, the age difference of the couple, the place of residence and the standard of living of the household. The latter proved very relevant in highlighting the direct impact of poverty on the increased risk of violence against women in both countries. The socio-cultural variables "age difference of the couple and education level of the couple" do not seem to influence the risk of domestic violence occurring. It was therefore found that regardless of the age or educational level of the spouses, the risk of violence against women in both countries remains the same.

Socioeconomically, the analysis remains similar about the couple's income for both countries with the exception of Burkinabe women with higher incomes than their husbands who are predisposed to less risk of violence compared to the household where the man earns the most.

Finally, we were able to identify some specific variables that had a specific impact on domestic violence for each country. This is the case in Cameroon where women who are not working (i.e. who are not economically occupied) are at a higher risk of domestic violence than their working counterparts.

Bibliography

Pr. Tola Olu Pearce, Gender and governance in africa: a conceptual framework for research and policy analysis and monitorin, August 2000, Addis Ababa, Ethiopia.

Kishor, S. and K. Johnson. 2006. Reproductive health and domestic violence: Are the poorest women uniquely disadvantaged? Demography Vol.43 (2): 293-397.

Kishor S. and L. Subaiya. 2008. Understanding Women's Empowerment: A Comparative Analysis of Demographic and Health Surveys (DHS) Data. DHS Comparative Report No. 20. Calverton, Maryland, USA: Macro International, Inc

UNFPA 2000. « Mettre fin à la violence à l'égard des femmes et des filles : Une priorité dans le domaine des droits et de la santé ». Etat de la population mondiale, Chapitre 3, 6p.

GASTINEAU B., GATHIER L., RAKOTOVAO I., 2009. « Nommer, compter et raconter la violence conjugale à Antananarivo ». Revue Tsingy : 11 :129-140

United Nations Population Fund (UNFPA). 1998. Gender Theme Group. UNFPA, New York.

McCloskey, L. A. (1996). Socioeconomic and coercive power within the family. Gender & Society, 10, 449–463. http://dx.doi.org/10.1177/089124396010004006

McCloskey, L. A., Williams, C., & Larsen, U. (2005). Gender inequality and intimate partner violence among women in Moshi, Tanzania. International Family Planning Perspectives, 31(3), 124–13

Introducing: The Second Sexism

Michael Barker

Abstract—Sociology played, and still enacts, a pivotal role in reducing sexism towards females, but has met an impasse in attending to disadvantages among males. The presentation offers that sociology will benefit from a new philosophical intersubjective 'myth.' That is, sociological data is meaningless in and of itself. Numbers require a metaphysical lens through which to be perceived and thereby understood. The need for a new myth is evident in differing interpretations of similar quantitative evidence for wife abuse and husband abuse both being serious social issues in the Global North. The myth of patriarchy provides a means to understand wife abuse a serious issue, but there is no myth through which to comprehend the degree to which wives abuse husbands. The disparity in interpreting data leads to my proposal that the foundation to the missing myth is Benetar's 'the second sexism' - the view that a set of masculine beliefs naturalise, trivialise and justify a set of disadvantages common among men and boys. At the end of the talk I show that sexism towards males intersects with sexism towards females. Which in this context means that attending to husband abuse is the next step to reduce wife abuse.

Keywords—domestic violence, feminism, patriarchy paradigm, sexism

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From Alternative Agro-Food Networks to Sustainable Livehoods in Counter-Urbanization: How Women Newcomers' Initiative and Mobility Develop in Rural Taiwan?

Zihling Huang

Abstract—Alternative agro-food networks are actively developing under influence of globalization. In the past, small-scale agricultural producer systems gradual downfall because of development of industrialization, productivism and inappropriate policies have gradually recovered under the diversified development of globalization, and combined with the ideals of post-productivist to rebirth. In this context, Taiwan as a post-industrial developmental state, rural development has been changed by economic and international trade. Farmers and consumers have been constrained in the agro-food system, but they play a positive role. Some of them even became country newcomers and residents in rural Taiwan. Many newcomers are women in rural Taiwan. It's special phenomenon that single women and mothers move to rural area for their freedom, health, children education, and other personal reasons without accompany. Women newcomers use the agency of themselves with their demand for the formation of this force to promote a series of actions and practice, such as rural social enterprise, community supported agriculture, civic movement, and agro-food education in rural Taiwan. These social innovations constitute sustainable livehoods and gender relations in multi-concepts. Fieldwork of this research was conducted in the northeast Taiwan, and participant observation and in-depth interview was adopted.

Keywords—The gender-specific dimensions of rural mobilization, counter-urbanization, women newcomers, alternative agro-food networks.

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Reconstructing National Identity, Constructing Global Identity: Kurdish Women Writers in Diaspora

Zhila Gholami

Abstract—In today's world, where each individual is known with a state, belonging to nowhere seems to be unbelievable and strange. Although, with the emergence of globalization, issues like nation-state and nationality have been diminished and national barriers no longer bear significance. However, there are still some people who struggle for their national identity. Statelessness, a condition held by Kurds, makes the question of identity and belonging a crucial issue for them. Statelessness of Kurds and their political condition leaded to migration of hundreds of thousands of Kurds across the world. A great amount of political and cultural activities of Kurds have taken place beyond the borders of Kurds homeland. Among Kurdish displaced communities, many writers, poets, and novelists began to write of their identity, homeland, history and the life in exile. Kurdish women writers also have produced literary works, although in less numbers. However, it is only recently that Kurdish literature has seen the emergence of a distinct body of work written in English, mostly by women. Accordingly, this paper is concerned with the literary productions of Anglophone Kurdish writers in diaspora who find literature as a way through which their national, cultural, and historical heritages could be preserved and transmitted. Writing in English provides a political voice for these writers which creates a literary space which enables them to have a new way of expression reflecting issues of identity, homeland, and belonging. This study aims to approach the Kurdish diasporic literature in English by female writers through conceptual framework of gender studies, diaspora studies, and post-colonial studies. Using the theories of Nira Yuval Davis and Floya Anthias, I attempt to discover the relationship between gender, and national identity. These theorists, raise a number of questions on issues of longing and belonging, as well as gender and nation. What this study intend to explore through the literary productions of Kurdish female writers is how women affect and are affected by national and ethnic processes. Moreover, it investigates how the construction of nationhood usually involves specific notions of both manhood and womanhood. One of the central arguments of Davis is the natural role of women-to bear children-and on its implications for the constructions of nations and women's social positioning. In other words, women as the biological producers of children/people, are also bearers of the collective within these boundaries. Considering nation as mother/women, she suggests that these are women who are given the social role of intergenerational transmitters of cultural traditions. It is within this context that the present study will indicate the significant role of Anglophone Kurdish women writers in constructing or reconstructing nation as well as national identity globally. These writers write stories of home, identity, and gender, through an international medium, to bring recognition for people of their nation globally and more importantly to be connected with the new and larger community.

Keywords—diaspora, gender, Kurdish literature, nation-building

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The Textual Criticism on the Age of 'Wan Li' Shipwreck Porcelain and Its Comparison with 'Whitte Leeuw' and Hatcher Shipwreck Porcelain

Yang Liu, Dongliang Lyu

Abstract—After the Wan li shipwreck was discovered 60 miles off the east coast of Tan jong Jara in Malaysia, numerous marvelous ceramic shards have been salvaged from the seabed. Remarkable pieces of Jing dezhen blue-and-white porcelain recovered from the site represent the essential part of the fascinating research. The porcelain cargo of Wan li shipwreck is significant to the studies on exported porcelains and Jing dezhen porcelain manufacture industry of Late-Ming dynasty. Using the ceramic shards categorization and the study of the Chinese and Western historical documents as a research strategy, the paper wants to shed new light on the Wan li shipwreck wares classification with Jingdezhen kiln ceramic as its main focus. The article is also discussing Jing dezhen blue-and-white porcelains from the perspective of domestic versus export markets and further proceeding to the systematization and analyses of Wan li shipwreck porcelain which bears witness to the forms, styles, and types of decoration that were being traded in this period. The porcelain data from two other shipwrecked projects -White Leeuw and Hatcher- were chosen as comparative case studies and Wan li shipwreck Jing dezhen blue-and-white porcelain is being reinterpreted in the context of art history and archeology of the region. The marine archaeologist Sten Sjostrand named the ship 'Wanli shipwreck' because its porcelain cargoes are typical of those made during the reign of Emperor Wan li of Ming dynasty. Though some scholars question the appropriateness of the name, the final verdict of the history is still to be made. Based on previous historical argumentation, the article uses a comparative approach to review the Wan li shipwreck blue-and-white porcelains on the grounds of the porcelains unearthed from the tomb or abandoned in the towns and carrying the time-specific reign mark. All these materials provide a very strong evidence which suggests that the porcelain recovered from Wan li ship can be dated to as early as the second year of Tianqi era (1622) and early Chongzhen reign. Lastly, some blue-and-white porcelain intended for the domestic market and some bowls of blue-and-white porcelain from Jing dezhen kilns recovered from the Wan li shipwreck all carry at the bottom the specific residue from the firing process. The author makes the corresponding analysis for these two interesting phenomena.

Keywords—blue-and-white porcelain, Ming dynasty, Jing dezhen kiln, Wan li shipwreck

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Analyzing the Nonya Wares on the Maritime Silk Road from the Perspective of Art History

Yang Liu, Dongliang Lyu

Abstract—Nonya ware is a field that has been ignored by domestic ceramic researchers. 'Nonya ware' refers to a pastel porcelain produced in China and ordered by the Peranakans of Malacca Straits in the late 19th and early 20th century. The porcelain which exhibits distinctive characteristics can be found in large numbers in Southeast Asia. From the perspective of art history, this article tries to outline the features of Nonya ware via its social-cultural background, decoration, and type and compare it with Chinese domestic pastel porcelain of that time. This comparison not only reflects the unique aesthetic of Peranakans but also presents the Nonya ware as an important expression of the blending of Chinese traditional culture and Western culture in the Malacca Straits. Red and green are its main colors, phoenix- and- peony pattern is a very popular and common decoration on its surface; the shape of nonya ware is simple, bowls, plates, teapots, jars, cups, basins, soap boxes, spoons, and other daily-use porcelain. Large quantity and high quality of Nonya wares symbolize the wealth and status of Baba-Nonya society. In this sense, Nonya wares can be seen not only as a type of porcelain but also as an important evidence of the cultural connection between Peranakan society in Malacca Straits and China. From the perspective of cultural exchange, Nonya ware can be considered as the last large-scale export of a single type of traditional Chinese porcelain. Further research into ceramic cultural exchange between these two places is meaningful and very much needed as it can open new horizons and as yet unexplored areas. To conclude, doing the research of nonya ware can help us understand the Peranakan society in Southeast Asian and ceramic exchange between China and Southeast Asia, as well as the situation of production of pastel porcelain in Jing dezhen of that time.

Keywords—Baba, China, cultural exchange, Nonya ware, the Peranakans, Phoenix and Peony pattern

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The Protection of Intangible Cultural Heritage from the Perspective of Art Anthropology: Case Study of Jingdezhen's Folk Ceramic Craft

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Abstract—The field survey method of anthropology focuses on the method of recording and the contextual research, which exactly meets the methodological requirements for the intangible cultural heritage research. Concerning the study of intangible cultural heritage, it is necessary to go to the people, to the fields, to observe them with the eyes of the insiders, to record them, and to feel deeply comprehended and explore them. Therefore, art anthropology and intangible cultural heritage protection in China can promote each other and develop together. Ceramic as tangible material culture, it is generally not in the category of intangible culture. However, the inheritance process of Jingdezhen's folk ceramic craft through 'oral teaching' between masters and apprentices includes all kinds of intangible cultural elements. From the angle of the protection of intangible cultural heritage, this article tries to discuss the intangible cultural factors contained in Jingdezhen's folk ceramic craft, combined with related current situations of rescuing and protecting Jingdezhen's folk porcelain techniques，and propose the slogan "saving people and saving environment" to maintain Jingdezhen's folk ceramic craft. At the same time, the maintenance of development of ceramic technique in a living state is the key to saving and protecting Jingdezhen's folk ceramic craft and intangible cultural heritage. In addition, the negligence of public participation in our current protection practices in Jingdezhen, we should advocate participatory strategies on the basis of understanding and appreciating the differences between emic and etic standpoints, taking advantage of the public wisdom and local knowledge, and awakening the cultural consciousness of people. At the same time, it is necessary to prevent the "cultural screening" and "cultural stratification" through the third-party assessment of intangible cultural heritage, the establishment of an emergency list to protect the diversity of our culture. How to make ceramic craft be better disseminated and inherited, and what other new forms can absorb in the future? It is also a subject that needs our further investigation in the future. In so doing, this article contributes to a growing body of attention in contemporary intellectual history on intangible culture inheritance as well as the anthropology of ideas.

Keywords—art anthropology, folk ceramic craft, intangible cultural heritage, Jingdezhen, protection and inheritance

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Research of the Domestic Sales Market of Jingdezhen Greenish-White Porcelain of South Song Dynasty from the Perspective of Archaeological Materials

Dongliang Lyu, Yang Liu

Abstract—Jingdezhen (a city in China) has become porcelains center of the world. From Song Dynasty (960-1279) to Qing Dynasty (1644-1912), the craftsmen who live in Jingdezhen had created many varieties of porcelains, such as greenish-white porcelain, blue and white porcelain, enamel porcelain, wucai porcelain, monochrome porcelain, famille rose and so on. However，only the greenish-white porcelain is the base of jingdezhen that will be able to move forward. In recent decades, with the development of archaeological excavations, a lot of new materials of Jingdezhen greenish-white porcelains were founded in China. Numerous works of Jingdezhen greenish-white porcelains constantly emerging. This article to do the research of domestic sales market of Jingdezhen greenish-white porcelain from the perspective of archaeological materials.

Firstly, this article counts and sorts out the unearthed greenish-white porcelains of Jingdezhen in South Song Dynasty (1127-1279). The article will classifies it through the name of administrative region in the South Song Dynasty (1127-1279). The paper focus on counting the type and the number of unearthed greenish-white porcelains and the location, which provides the material basis for the study of the greenish-white porcelains of Jingdezhen's domestic sales market in Southern Song Dynasty.

Secondly, using statistical methods of Mathematics to do some detailed statistics for the number of greenish- white porcelains, to draw the distribution map of sites, to analysis the Jingdezhen greenish-white porcelains of the domestic market in Southe Song Dynasty from three aspects- the range of regional distribution, characteristics of sales of goods and market share, and focus on the analysis of the reasons for these characteristics that produced. Then, making use of the criteria of Hutian kiln (the biggest kiln in Jingdezhen) in Southe Song Dynasty, the market of greenish-white porcelains of South Song Dynasty is divided into early time (1127-1224) and late time (1225-1279). And summarize the distribution characteristics of each period of the domestic market of greenish-white porcelains in Jingdezhen. At the same time，in order to have comprehensive knowledge of the domestic sales market of Jingdezhen greenish-white porcelains, the article compares the sales market of Jizhou kiln of same time with the domestic sales market of greenish-white porcelains of South Song Dynasty in Jingdezhen.

Finally, after studying and analyzing the archaeological materials, it is easy to find that the dominating sales market of Jingdezhen greenish-white porcelain in the early time (1127-1224) of South Song Dynasty was in Southeast China. Besides, the dominating sales market in the late time (1225-1279) was in Southwest China.

Keywords—Dynasty, Jingdezhen, greenish-white Porcelain, Sales Market, Archaeological Report.

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Unveiling Islamic Culture of Conflict and Compromise in the Ideological Struggles of Bangladeshi Women: In Quest for the Elusive Women Empowerment

Mohammed Rafiqul Islam

Abstract—Bangladesh is a third world nation with ancient traditions, vivid customs, and specific lifestyles. Its dominant religion is Islam although there are many other religions practiced around the country by smaller religious communities. Since Islam dominates other religions in the nation, most women are expected to act in a certain way determined by religion. Failure to do so results in rejection, mockery, verbal and sometimes physical assaults. Though women constitute half of the world's inhabitant, their involvement in diverse activities is not equal to men, even today. The fact is witnessed in developing countries in particular, because of diverse grounds in each country. The paper assesses the role of the dominant religion (Islam) in Bangladesh, how it affects the lifestyles and the roles that women have in the nation. It explores how religion views the women's contribution to the society, women's roles and overall influence on the society. It explores the status quo of things and makes predictions about the future status of women empowerment in Bangladesh.

Keywords—Bangladesh, empowerment, Islam, religion, society, women

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A Trail of Decoding a Classical Riddle: An Analysis of Russian Strategic Military Documents

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Abstract—Over the last years, the Russian Federation has become one of the central points on the security agenda of the most important international actors, due to its reloaded aggressiveness of foreign policy. Vladimir Putin, the recent reelected president of the Russian Federation, has proven that Russia can and has the willingness to become the powerful actor that used to be during the Cold War. Russia's new behavior on the international scene showed that the Russian state has not only expansionist intentions (understood in terms of both territory and ideology), but also the necessary resources to build an empire that may have the power to counterbalance the influence of the United States and stop the expansion of the North-Atlantic Treaty Organization in an equation understood of multipolar Russian view. But, in order to do this, there is necessary to follow a well-established plan or policy. Thus, the aim of the paper is to discuss how has the foreign policy of the Russian Federation evolved, to briefly identify and analyze some of the factors that shape and influence Russian foreign policy and behavior, in order to reshape a Russian (Soviet) profile so far considered antiquated. Our approach is an argument in favor of the analyses of the recent evolutions embedded in the course of history. In this context, the paper will include analytical thoughts about the Russian foreign policy and the latest strategic documents (security strategy and military doctrine) adopted by the Putin administration, with the purpose to highlight the main direction of action followed by all these documents together. The paper concludes that the military component is to be found in all these strategic documents, as well as in the core of Russian national interest, aspect that proves that Russia is still the adept of the traditional realist paradigm, reshaped in a Russian theory of the multipolar world.

Keywords—hybrid warfare, military component, military doctrine, Russian foreign policy, security strategy

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The Application of Article 111 of the Constitution of Bangladesh in the Criminal Justice System as a Sentencing Guideline

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Abstract—Generally, the decision of the higher court is binding on its subordinate courts. As provided in Article 111 of the Constitution, 'the law declared by the Appellate Division (AD) shall be binding on the High Court Division (HCD) and the law declared by either division of the Supreme Court shall be binding on all courts subordinate to it.' This means the judicial discipline requires the HCD to follow the decision of the AD and that it is necessary for the lower tiers of courts to accept the decision of the higher tiers as a binding precedent. Analyzing the application of Article 111 of the Constitution in the criminal justice system as a sentencing guideline, the paper, by examining whether there is any consistency in decision between one HC Bench and another HC Bench, explores whether HCD can per incuriam its previous decision. In doing so, the Death Reference (DR) Cases are contemplated. Furthermore, the paper shall examine whether the Court of Session follows the decision of the HCD while using their discretion to make the choice between death and imprisonment for life under section 302 of PC. The paper argues due to the absence of any specific direction for sentencing and inconsistency in jurisprudence among the HCD; the subordinate courts are in a dilemma.

Keywords—death reference, sentencing factor, sentencing guideline, criminal justice system and constitution

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Ecological and Health Risk Assessment of the Heavy Metal Contaminant in Surface Soils around Effurun Market

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Abstract—Heavy metal contaminations in soil have received great attention. Anthropogenic activities such as vehicular emission, industrial activities and constructions have resulted in elevated concentration of heavy metals in the surface soils. The metal particles can be free from the surface soil when they are disturbed and re-entrained in air, which necessitated the need to investigate surface soil at market environment where adults and children are present on daily basis. This study assesses concentration of heavy metal pollution, ecological and health risk factors in surface soil at Effurun market. 8 samples were collected at household material (EMH), fish (EMFs), fish and commodities (EMF-C), Abattoir (EMA 1 & 2), fruit sections (EMF 1 & 2) and lastly main road (EMMR). The samples were digested and analyzed in triplicate for contents of Lead (Pb), Nickel (Ni), Cadmium (Cd) and Copper (Cu). The mean concentration of the Pb mg/kg (112.27 ± 1.12) and Cu mg/kg (156.14 ± 1.10) were highest in the abattoir section (EMA 1). The mean concentrations of the heavy metal were then used to calculate the ecological and health risk for people within the market. Pb contamination at EMMR, EMF 2, EMFs were moderately while Pb shows considerable contamination at EMH, EMA 1, EMA 2 and EMF-C sections of the Effurun market. The ecological risk factor varies between low to moderate pollution for Pb and EMA 1 has the highest potential ecological risk that falls within moderate pollution. The hazard quotient results show that dermal exposure pathway is the possible means of heavy metal exposure to the traders while ingestion is the least sources of exposure to adult. The ingestion suggested that children around the EMA 1 have the highest possible exposure to children due to hand-to-mouth and object-to-mouth behaviour. The results further show that adults at the EMA1 will have the highest exposure to Pb due to inhalation during burning of cow with tyre that contained Pb and Cu. The carcinogenic risk values of most sections were higher than acceptable values, while Ni at EMMR, EMF 1 & 2, EMFs and EMF-C sections that were below the acceptable values. The cancer risk for inhalation exposure pathway for Pb (1.01E+17) shows a significant level of contamination than all the other sections of the market. It suggested that the people working at the Abattoir were very prone to cancer risk.

Keywords—carcinogenic, ecological, heavy metal, risk

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Ecological Risk Assessment of Informal E-Waste Processing in Alaba International Market, Lagos, Nigeria

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Abstract—Informal electronic waste (e-waste) processing is a crude method of recycling, which is on the increase in Nigeria. The release of hazardous substances such as heavy metals (HMs) into the environment during informal e-waste processing has been a major concern. However, there is insufficient information on environmental contamination from e-waste recycling, associated ecological risk in Alaba International Market, a major electronic market in Lagos, Nigeria. The aims of this study were to determine the levels of HMs in soil, resulting from the e-waste recycling; and also assess associated ecological risks in Alaba international market. Samples of soils (334) were randomly collected seasonally for three years from fourteen selected e-waste activity points and two control sites. The samples were digested using standard methods and HMs analysed by inductive coupled plasma optical emission. Ecological risk was estimated using Ecological Risk index (ER), Potential Ecological Risk index (RI), Index of geoaccumulation (Igeo), Contamination factor (Cf) and degree of contamination factor (Cdeg). The concentrations range of HMs (mg/kg) in soil were: 16.7-11200.0 (Pb); 14.3-22600.0 (Cu); 1.90-6280.0 (Ni); 39.5-4570.0 (Zn); 0.79-12300.0 (Sn); 0.02-138.0 (Cd); 12.7-1710.0 (Ba); 0.18-131.0 (Cr); 0.07-28.0 (V), while As was below detection limit. Concentrations range in control soils were 1.36-9.70 (Pb), 2.06-7.60 (Cu), 1.25-5.11 (Ni), 3.62-15.9 (Zn), BDL-0.56 (Sn), BDL-0.01 (Cd), 14.6-47.6 (Ba), 0.21–12.2 (Cr) and 0.22-22.2 (V). The trend in ecological risk index was in the order Cu > Pb > Ni > Zn > Cr > Cd > Ba > V. The potential ecological risk index with respect to informal e-waste activities were: burning > dismantling > disposal > stockpiling. The index of geo accumulation indices revealed that soils were extremely polluted with Cd, Cu, Pb, Zn and Ni. The contamination factor indicated that 93% of the studied areas have very high contamination status for Pb, Cu, Ba, Sn and Co while Cr and Cd were in the moderately contaminated status. The degree of contamination decreased in the order of Sn > Cu > Pb >> Zn > Ba > Co > Ni > V > Cr > Cd. Heavy metal contamination of Alaba international market environment resulting from informal e-waste processing was established. Proper management of e-waste and remediation of the market environment are recommended to minimize the ecological risks.

*Keywords—*Alaba international market, ecological risk, electronic waste, heavy metal contamination

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Permeodynamic PM Filtration for Improved Air Quality

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Abstract—Particulate matter (PM) in the air we breathe is detrimental to health. Overcoming this problem has attracted interest and prompted research on the use of PM filtration in commercial buildings and homes to be carried out. The consensus is that tangible health benefits can result from the use of PM filters in most urban environments, to clean up the building's fresh air supply and thereby reduce exposure of residents to airborne PM. The authors have investigated and are developing a new large-scale Permeodynamic Filtration Technology (PFT) capable of permanently filtering and removing airborne PMs from outdoor spaces, thus also benefiting internal spaces such as the interiors of buildings. Theoretical models were developed, and laboratory trials carried out to determine, and validate through measurement permeodynamic filtration efficiency and pressure drop as functions of PM particle size distributions. The conclusion is that PFT offers a potentially viable, cost effective end of pipe solution to the problem of airborne PM.

Keywords—Air Filtration, Particulate Matter, Particle Size Distribution, Permeodynamic Technology.

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The Evaluation of Gravity Anomalies Based on Global Models by Land Gravity Data

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Abstract—The Earth system generates different phenomena that are observable at the surface of the Earth such as mass deformations and displacements leading to plate tectonics, earthquakes, and volcanism. The dynamic processes associated with the interior, surface, and atmosphere of the Earth affect the three pillars of geodesy: shape of the Earth, its gravity field, and its rotation. Geodesy establishes a characteristic structure in order to define, monitor, and predict of the whole Earth system. The traditional and new instruments, observables, and techniques in geodesy are related to the gravity field. Therefore, the geodesy monitors the gravity field and its temporal variability in order to transform the geodetic observations made on the physical surface of the Earth into the geometrical surface in which positions are mathematically defined. In this paper, the main components of the gravity field modeling, (Free-air and Bouguer) gravity anomalies are calculated via recent global models (EGM2008, EIGEN6C4, and GECO) over a selected study area. The model-based gravity anomalies are compared with the corresponding terrestrial gravity data in terms of standard deviation (SD) and root mean square error (RMSE) for determining the best fit global model in the study area at a regional scale in Turkey. The least SD (13.63 mGal) and RMSE (15.71 mGal) were obtained by EGM2008 for the Free-air gravity anomaly residuals. For the Bouguer gravity anomaly residuals, EIGEN6C4 provides the least SD (8.05 mGal) and RMSE (8.12 mGal). The results indicated that EIGEN6C4 can be a useful tool for modeling the gravity field of the Earth over the study area.

Keywords—Free-air gravity anomaly, Bouguer gravity anomaly, global model, land gravity.

I. INTRODUCTION

THE measurement and mapping the Earth's surface is in charge of geodesy with respect to the classical definition of Helmert [1]. Although this effective notion is still valid, the scope of geodesy has been expanded, particularly through the developments in space-geodetic technologies. Today, geodesy is a branch of science devoted to determining and representing the size, shape, rotation, and gravitational field of the Earth and their variations in a three-dimensional (3D) space over time. The modern concept of geodesy is characterized by three pillars: (i) geometry and kinematics, (ii) orientation and rotation of the Earth, and (iii) gravity field and its variability [2]. The third pillar of this geodetic vision is allocated to determining-monitoring the gravity field of the Earth and its variations over spatio-temporal scales. The knowledge of the geometry of the Earth's gravity field in essence fulfils the transformation task of geodetic measurements made in gravity-dependent physical surface into the mathematical (geometrical) surface for defining positions. Also, the equipotential surfaces and plumb-lines are required for applications including the topographical surface such as gravity-driven water flow [3]. The understanding of the Earth's gravity field is essential not only for geodesy, but today it is also crucial for a broad range of geophysical and geological utilizations from regional to global scales. At regional scales, gravity information can efficiently be used in a diverse field of geologic challenges about upper crust, such as: describing characteristics related to natural hazards and searching the natural resources. At global scales, gravity information is utilized in determining the Earth's shape, calculating the orbits of artificial satellites, monitoring the changes in the mass of the Earth, serving geophysical interpretation, mapping lithospheric form, and tracking geodynamic structure of the Earth system [4].

Traditionally, geodetic measurements are based on three different surfaces: (1) the physical surface of the Earth, (2) the ellipsoid, a mathematical reference surface, (3) the equipotential surface best fitting with mean sea level (MSL) at the calm ocean, called the geoid. The understanding of the Earth's gravity field is vital for clearly defining of these three surfaces.

The vertical positioning that requires the "height" and the corresponding datum surface is an essential component of the most of the geodetic applications. The basis for the determination of height is accurate gravity data. Conventionally, the actual heights of the points on the Earth's physical surface are determined by incorporating geometric levelling and gravity measurements. The heights are calculated as curved distances along the local plumb-line (the gravity vector) from the geoid at each point. These "orthometric" heights are more useful in mapping, surveying, navigation, and other geophysical applications, because they better relate to water-flow in the geophysical sense. While a geoid better relates heights to MSL, determining orthometric heights is labour-intensive and time-consuming. The extensive utilization of Global Navigation Satellite Systems for rapid determining accurate "ellipsoidal" heights (related to a geodetic reference ellipsoid) have triggered the necessity for accurate (and rapid) determination of orthometric heights associated with the geoid. The ellipsoidal heights are inconvenient for topographic/floodplain mapping due to the topographical irregularities. The geoid is a viable option for height transformation between the ellipsoidal heights and

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orthometric heights. The geoid determination has a robust connection with the measurement or the calculation of the gravity acceleration near the Earth's surface [5], [6]. In using the Earth's gravity field to determine the geoid, the acceleration of gravity is obtained by point gravity measurements located at the Earth's physical surface. In the geoid determination, these gravity values must be reduced onto the geoid by converting them into gravity anomalies [7].

A global model (GM) of the Earth's gravity field is a mathematical approximation of the real gravity potential and allows computation of the physical quantities connected to the gravity field, i.e., gravitational potential, gravity disturbance, gravity anomaly, height anomaly, geoid undulation at each position in 3D space [8]. The operational and scientific progressions in space-based techniques provide significant developments in the global gravity field model determinations. The launches of the CHAllenging Minisatellite Payload (CHAMP) [9], Gravity Recovery And Climate Experiment (GRACE) [10], and Gravity field and steady-state Ocean Circulation Explorer (GOCE) [11] missions have revolutionized our understanding of the global Earth's gravity field and its temporal changes by numerous GMs [12]. Gravity data can be acquired from satellite, airborne and terrestrial measurements at different spatial resolutions. The air- and space-based data have some disadvantages related mainly to the frailty of the gravitational field with altitude. Terrestrial gravity data provide full-field gravity field information oftentimes with a heterogeneous data density. Therefore, air- and space-based gravity data are combined with ground-based gravity data to derive combined GMs [13], [14].

The main purpose of this paper is the evaluation of the accuracy of combined high-degree GMs: Earth Gravitational Model 2008 (EGM2008) [15], European Improved Gravity model of the Earth by New techniques (EIGEN-6C4) [16], and GOCE-EGM2008 COmbined model (GECO) [17] for approximating the gravity field of the Earth. The land gravity data in the study area were used to quantify the GMs' performance in assessing the combined model that best coincides the study area in Turkey for gravity field modelling at a regional scale, and the comparison results are presented in terms of the SD and RMSE over the study area.

II. THEORETICAL CHARACTERIZATION

A. Gravity Anomaly

The measured gravity at a point on the Earth's physical surface is affected by sources that form the Earth's gravity field. Gravity caused by known sources such as the rotation of the Earth, the distance from the geocentre, topographic relief, tidal variation, and gravity meter fluctuations can be removed from the measured gravity by using realistic Earth models. The difference between the measured gravity on the physical surface of the Earth and the corresponding value calculated by a gravity field model of the Earth for the same point with respect to the altitude, latitude, and topographical irregularities is called gravity anomaly [18]. In geodesy, the scalar difference between gravity measured at a point that has been reduced to the geoid (g_P) and a theoretical value of the normal gravity at that point predicted from a reference ellipsoid (γ) (for the same geodetic latitude) is defined as the gravity anomaly (Δg) [19]:

$$\Delta g = g_P - \gamma \qquad (1)$$

Gravity anomalies are defined as Free-air and Bouguer gravity anomalies by applying a sequence of gravity corrections to the measured gravity. In the geodetic literature, the computation of gravity anomalies is characterized as a reduction process where measured gravity is reduced to the geoid [20]. This reduction procedure comprises a number of corrections that must be applied to the measured gravity value: the latitude correction, the Free-air correction, and the (simple) Bouguer correction [21].

Latitude correction: The theoretical gravity that is a function of latitude should be removed for leaving only local effects. This process is called latitude correction that accounts the reference ellipsoid's gravity effect. The Somigliana-Pizetti closed-form expression [22] is a standard in geodesy for calculating the normal gravity on the surface of a geocentric reference ellipsoid that is used to represent the shape of the Earth [23]:

$$\gamma = \gamma_a \frac{1 + k \sin^2 \phi}{\sqrt{1 - e^2 \sin^2 \phi}} \qquad (2)$$

where γ_a is normal gravity at the equator of the reference ellipsoid, k is the normal gravity constant, ϕ is the geocentric latitude of the gravity measurement point, and e^2 is the square of the first numerical eccentricity of the reference ellipsoid.

Free-air correction: The elevation of the point where each gravity measurement was made must be reduced to a reference datum to compare the whole profile. This is called the Free-air correction (F), and when it is combined with the latitude correction leaves the Free-air anomaly. The gravity measurement point is almost never located exactly on the surface of the reference ellipsoid. This is accounted by the utilization of the vertical gradient of normal gravity as an approximation [7]:

$$F = -\frac{\partial \gamma}{\partial R} H \approx 0.3086 H \qquad (3)$$

where R is the radius of the spherical Earth model (in kilometers) and H is the elevation of the measurement point in free air (above or below the geoid) (in meters). Conventionally, the linear approximation ($0.3086H$) is sufficient for many practical purposes. However, a more precise expression for the Free-air correction can be derived by a second-order approximation that accounts the oblate shape of the Earth [23]. Consequently, the Free-air gravity anomaly (Δg_{FA}) becomes:

$$\Delta g_{FA} = g_P + F - \gamma \qquad (4)$$

Bouguer correction: The attraction of any mass between the physical surface of the Earth and the vertical datum surface should be corrected. Hence, the topographic masses between the points where gravity were measured (Earth's physical surface) and the geoid are modelled as being made up of an infinite number of plates of thickness H. These plates have no lateral variation in density, but each slab may have a different density than the one above or below it. This is called the Bouguer correction (*B*) [24].

$$B = 2\pi G \rho H \qquad (5)$$

where *G* is the gravitational constant and ρ is the topographic density. If the standard topographic mass density is considered as $\rho=2.67 \ g/cm^3$, the Bouguer correction becomes:

$$B = 0.1119H \qquad (6)$$

Thus, the simple Bouguer anomaly can be defined as:

$$\Delta g_B = g_P + F - \gamma - B \qquad (7)$$

This simple process is refined by taking into account the actual topography's deviation from the Bouguer plate. This process is called as terrain correction. The Bouguer correction and the corresponding Bouguer anomalies are called complete (refined) or simple with regard to the application of terrain correction. In practice, the Bouguer reduction should be actualized in two stages as the effect of the Bouguer plate and the terrain. The amount of the terrain correction is ~50 mgal for the mountains (*H≈3000 m*) [22].

B. Global Models

The determination of the Earth's global gravity field is one of the main tasks of geodesy. Since the 1960s, the Earth's real gravitational potential has been approximated from the combination of satellite tracking data, land and ship-tracking gravity data, marine gravity anomalies derived by using spherical harmonics [25]. The mathematical representation of the gravitational potential of the Earth in the space by spherical harmonic coefficients is called GM. GMs provide knowledge about the Earth, its shape, its interior and fluid envelope. All related gravity field functionals can be calculated by GMs. There are essentially two classes of GMs: satellite-only and combined models. The satellite-only models are calculated by satellite measurements alone, whereas for the combined models additionally terrestrial gravity measurements (over the continents) and altimetry measurements (over the oceans) are used [8].

The gravity anomaly (*Δg*) can be represented by spherical harmonic expansion with the following equation [26]:

$$\Delta g(\mathrm{r}, \lambda, \varphi) = \frac{G \cdot M}{r^2} \sum_{\ell=0}^{\ell_{\max}} \left(\frac{R}{r}\right)^{\ell} (\ell-1) \sum_{m=0}^{\ell} \overline{P}_{\ell m}(\sin \varphi) \left[\overline{C}_{\ell m} \cos m\lambda + \overline{S}_{\ell m} \sin m\lambda\right] \quad (8)$$

The notations are: *(r, λ, φ)*; radius, longitude, and latitude of the computation point, *G;* gravitational constant, *M*; mass

of the Earth, *R*; reference radius of the Earth, *ℓ, m*; degree, order of spherical harmonics, $\overline{P}_{\ell m}$; Lengendre functions (fully normalised), $\overline{C}_{\ell m}, \overline{S}_{\ell m}$; Stokes' coefficients (fully normalised).

The launches of CHAMP, GRACE, and GOCE have led to significant achievements in the determination of the Earth's gravity field. Thus, the technological and scientific developments in artificial satellite techniques and calculation algorithms resulted in releasing high-degree combined GMs [27]. EGM2008, EIGEN-6C4, and GECO (high-degree combined models) that were mentioned in the Introduction section, are studied.

Earth Gravitational Model 2008: EGM2008 is a spherical harmonic model of the Earth's gravitational potential, complete to degree and order 2159, with additional spherical harmonic coefficients extending up to degree 2190 and order 2159. It is released by the National Geospatial-Intelligence Agency (NGA). EGM2008 is based on a least squares combination of the ITG-GRACE03S gravitational model along with its associated error covariance matrix, with 5′ × 5′ free-air gravity anomaly grid formed from terrestrial, altimetry-derived and airborne gravity data. The spectral content of EGM2008 was supplemented by a new elevation database based on the Shuttle Radar Topographic Mission solution along with other databases (GTOPO30, ICESat, etc.). EGM2008 represents a significant milestone in the Earth's gravity field modelling, by demonstrating for the first time ever, that given accurate and detailed gravimetric data, a single GM may provide the requirements of a very wide range of applications [28].

European Improved Gravity Model of the Earth by New Techniques 2014: EIGEN-6C4 is a static global combined gravity field model up to degree and order 2190. It has been generated by the collaboration between GeoForschungsZentrum (Geo-Research Centre) (GFZ) Potsdam and Groupe de Recherche de Géodésie Spatiale (Space Geodesy Research Group) (GRGS) Toulouse. EIGEN-6C4 is developed by the combination of LAGEOS, GRACE RL03 GRGS, GOCE-SGG (November 2009 till October 2013) data plus 2′ × 2′ free-air gravity anomaly grid (DTU12 altimeter data for the oceans, EGM2008 geoid height grid for the continents). The incorporation of these different data sets has been done by normal equations, which are generated as a function of their resolution and accuracy [16].

Global Gravity Model by Locally Combining GOCE Data and EGM2008: GECO is a global gravity model up to degree and order 2190, computed by incorporating the GOCE-only TIM R5 solution into EGM2008. The EGM2008 geoid is computed on a global spherical grid of resolution 30' x 30' by making a synthesis from EGM2008 coefficients up to degree 359. The GOCE geoid undulations on the same grid are computed by making a synthesis from the TIM R5 coefficients up to degree 250. Two geoid grids are combined with a least-squares adjustment process. Finally, the GECO spherical harmonic coefficients are computed as a weighted average of the coefficient errors of EGM2008 and TIM R5 combined

solution. From degree 360 to degree 2190, the GECO coefficients are the same of EGM2008 [17].

III. STUDY AREA, TERRESTRIAL DATA, EVALUATION METHODOLOGY

The study area covering the western Anatolian parts of Turkey is limited by the geographical boundaries: 36°.5 N ≤ φ ≤ 40°.5 N; 26°.5 E ≤ λ ≤ 33°.0 E, and it approximately defines a total area of 180000 km² (~370 km x ~480 km) with a rough and mountainous (*H>1000 m*) topography (Fig. 1).
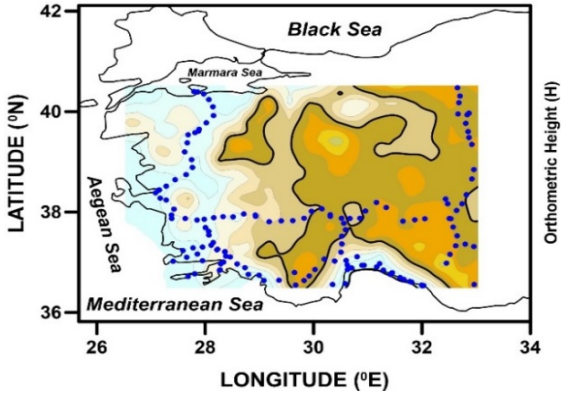
Fig. 1 The location - topography of the study area (heights in m) and the land gravity points

The evaluation procedure of gravity anomalies refers to a terrestrial gravity data set over the study area that is comprised of 145 land gravity points (blue points in Fig. 1) compiled by BGI. The land gravity data are in the Geodetic Reference System-1980. Although mainly measured before 1971, the measured land gravity values have been connected to the International Standardization Net 1971 [29] system. The accuracy of land gravity values is about 0.25 ~ 0.75 mGal.

The comparative evaluation of the GM based (Free-air and Bouguer) gravity anomalies was carried out by the residuals ($\delta \Delta g$) between the measured (terrestrial) gravity anomaly (Δg_T) and the gravity anomaly calculated by GMs (Δg_{GM}) using the following equation:

$$\delta \Delta g = \Delta g_T - \Delta g_{GM} \qquad (9)$$

The quantitative statistical evaluation of gravity anomaly residuals ($\delta \Delta g$) was executed with the minimum, maximum, mean, SD, and RMSE values as the common criteria for the accuracy [30], [31]. SD and RMSE are defined by:

$$SD = \sqrt{\frac{1}{n} \sum_{i=1}^{n} \left(\delta \Delta g_i - M \Delta g \right)^2} \qquad (10)$$

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^{n} \left(\delta \Delta g_i \right)^2} \qquad (11)$$

where $M\Delta g$ represents the mean value of the gravity anomaly

residuals, n is the number of terrestrial gravity points, and i refers to the residual sequence.

IV. COMPARATIVE STUDY

The measured gravity anomalies based on terrestrial observations at discrete points provide an estimated accuracy of the GMs in the process of GM comparative evaluation. The usual and accepted practice is to select the GM that has a best fit to the terrestrial data. The evaluation of GMs focuses on the gravity anomaly residuals. In the GM approach of the evaluation procedure, the gravity anomalies based on EGM2008, EIGEN-6C4, and GECO are computed from the grids by the calculation service of International Centre for Global Earth Models (ICGEM) web page [32]:

The Free-air gravity anomaly is defined as the magnitude of the gradient of the downward continued potential on the geoid minus the magnitude of the gradient of the normal potential on the ellipsoid. The (simple) Bouguer gravity anomaly is defined by the Free-air gravity anomaly minus the attraction of the Bouguer plate. It is computed by the Free-air gravity anomaly minus *2πGρH*. The spherical harmonic model DTM2006 [33] is used for the calculation of the topographic heights (*H*). A constant topographic mass density of *2.67 g/cm³* has been used for *H≥0* m [26]. The spherical approximation of the Free-air and (simple) Bouguer gravity anomalies are calculated by (8). The statistical values of these gravity anomalies based on GMs are given in Table I.

TABLE I
STATISTICS OF GRAVITY ANOMALIES BASED ON GMs OVER THE STUDY AREA (UNITS IN MGAL)

GM	FREE-AIR GRAVITY ANOMALY			
	Min.	Max.	Mean	SD
EGM2008	-138.27	280.62	53.41	39.09
EIGEN6C4	-138.79	277.76	53.40	39.07
GECO	-141.39	275.54	53.39	39.07
GM	BOUGUER GRAVITY ANOMALY			
	Min.	Max.	Mean	SD
EGM2008	-105.62	127.52	-31.19	46.46
EIGEN6C4	-105.33	128.16	-31.19	46.17
GECO	-105.26	126.99	-31.21	46.18

In order to specify the occurrence and magnitude of gravity anomaly residuals, the graphical depictions were used for the qualitative evaluation of GMs by producing the Free-air and (simple) Bouguer gravity anomaly residual maps with regard to (9) for each GM by the Surfer® 13 software (Figs. 2-4). The statistical parameters of the Free-air and (simple) Bouguer gravity anomaly residuals associated with GMs are presented in Table II.

V. RESULTS AND CONCLUSIONS

The analysis of the explanatory statistics (minimum, maximum, mean, SD, and RMSE) of the Free-air and (simple) Bouguer gravity anomaly residuals given in Table II reveals that EGM2008, EIGEN6C4, and GECO solutions are very close to each other. The differences between the SD and
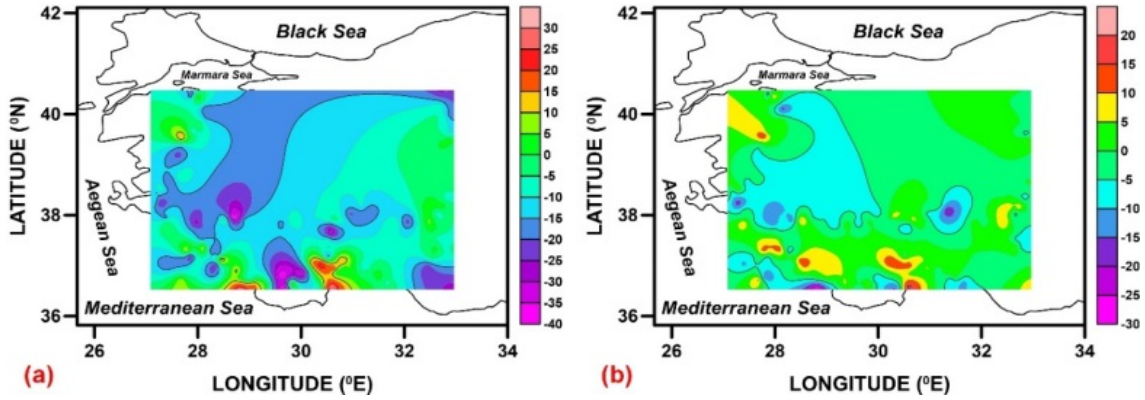
RMSE values are quite small.

Fig. 2 EGM2008 gravity anomaly residual map (residuals in mgal) (a) Free-air (b) Bouguer
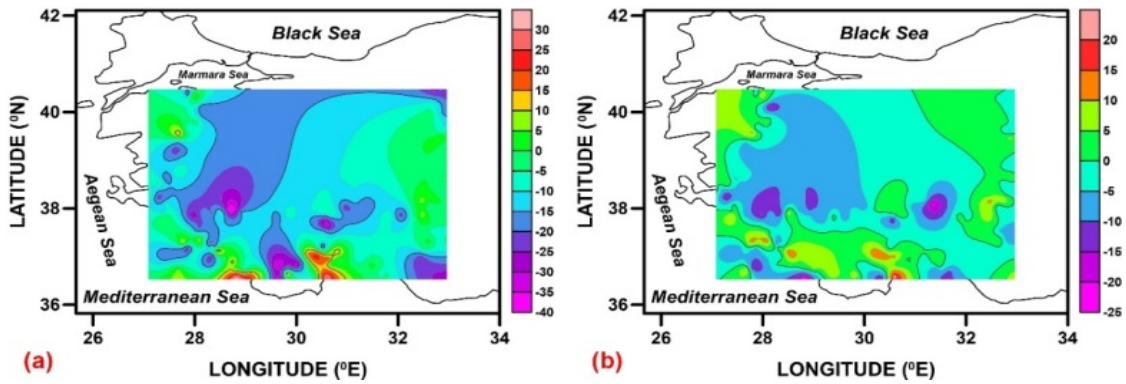

Fig. 3 EIGEN6C4 gravity anomaly residual map (residuals in mgal) (a) Free-air (b) Bouguer
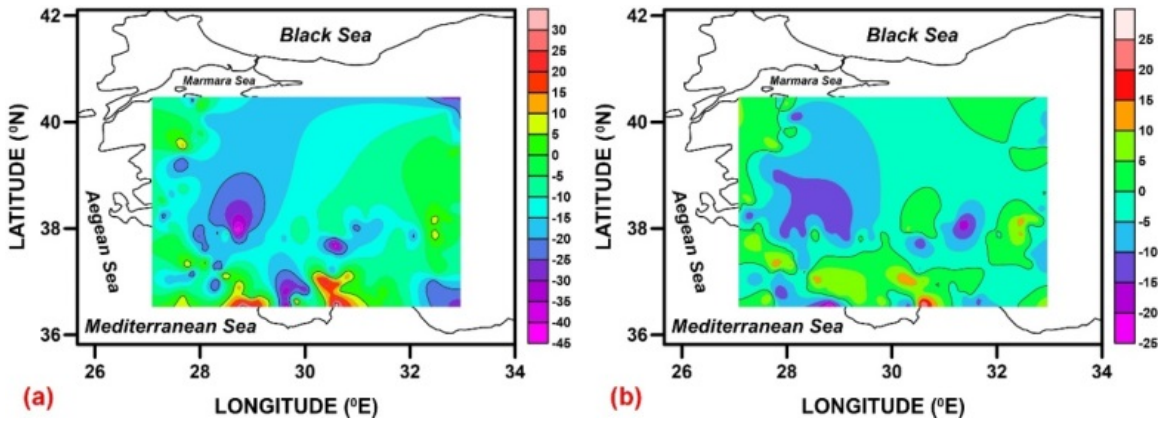

Fig. 4 GECO gravity anomaly residual map (residuals in mgal) (a) Free-air (b) Bouguer

TABLE II
STATISTICAL INFORMATION OF GRAVITY ANOMALY RESIDUALS BASED ON GMS OVER THE STUDY AREA (UNITS IN MGAL)

GM	Residual	Min.	Max.	Mean	Range	SD	RMSE
EGM2008	Free-air	-43.29	32.59	-7.90	75.88	13.63	15.71
	Bouguer	-29.72	24.01	-1.19	53.73	8.13	8.19
EIGEN6C4	Free-air	-42.86	35.04	-7.96	77.90	13.72	15.82
	Bouguer	-24.03	24.56	-1.25	48.59	8.05	8.12
GECO	Free-air	-46.01	35.29	-8.15	81.30	13.88	16.06
	Bouguer	-26.07	26.70	-1.44	52.77	8.16	8.26

The visual interpretation of the gravity anomaly residual indicates that EGM2008, EIGEN6C4, and GECO have a

similar Free-air and (simple) Bouguer gravity anomaly approximation over the study area.

SD is within a range of; 13.63 mGal to 13.88 mGal for Free-air gravity anomaly residual, 8.05 mGal to 8.16 mGal for (simple) Bouguer gravity anomaly residual. RMSE is within a range of; 15.71 mGal to 16.06 mGal for Free-air gravity anomaly residual, 8.12 mGal to 8.26 mGal for (simple) Bouguer gravity anomaly residual.

When the results presented in Table II are examined, the least SD (13.63 mGal) and RMSE (15.71 mGal) were obtained by EGM2008 for the Free-air gravity anomaly residuals. SDs and RMSEs of the GMs have a decreasing sequence as EGM2008 < EIGEN6C4 < GECO for the Free-air gravity anomaly modelling. For the (simple) Bouguer gravity anomaly residuals, EIGEN6C4 provides the least SD (8.05 mGal) and RMSE (8.12 mGal) with a decreasing sequence as EIGEN6C4 < EGM2008 < GECO.

From the minimum, maximum, and mean values in Table II, it is apparent that EGM2008, EIGEN6C4, and GECO overestimate the Free-air gravity anomalies. The approximations of the (simple) Bouguer gravity anomalies based on EGM2008, EIGEN6C4, and GECO are all largely negative (Figs. 2 (b)-4 (b)). This is a well-known characteristic of Bouguer gravity anomalies of land. The SDs of (simple) Bouguer gravity anomaly residuals in Table II are smaller than the SDs of Free-air gravity anomaly residuals due to the fact that (simple) Bouguer gravity anomalies are supposed to be smoother than Free-air gravity anomalies.

From the visual analysis of the gravity anomaly residual maps (Figs. 2-4), the Free-air gravity anomaly residuals exhibit identical spatial characteristics, but the magnitudes are different. The spatial structure of the (simple) Bouguer gravity anomaly residuals is similar, but the magnitudes are different.

The comparative results in terms of SD and RMSE of the evaluation of GM based gravity anomalies at a regional scale led the following conclusions:
- The approximation of the Free-air gravity anomalies shows that EGM2008, EIGEN6C4, and GECO are almost identical with a slight advantage of EGM2008 over the study area.
- The (simple) Bouguer gravity anomaly modelling of EGM2008, EIGEN6C4, and GECO are similar with a slight advantage of EIGEN6C4. The data contributions of the satellite gravity mission GOCE to EIGEN6C4 have made improvement particularly in modelling the Bouguer gravity anomalies.

Moreover, the qualitative and quantitative analysis results of this study suggest that:
- Due to its better statistics (in terms of SD and RMSE), the use of EIGEN6C4 can be recommended as a feasible GM for gravity anomaly modelling tool in geodetic applications at regional-national scales in Turkey.
- By using a densified terrestrial gravity measurement network with an improved spatial distribution, the Free-air and (simple) Bouguer gravity anomaly can be modelled by GMs with more accuracy.

Furthermore, a major mission of geodesy is to calculate the functionals of the gravity field as accurately as possible from a GM and present these functionals to other geosciences. Therefore, further and future analysis of recent combined high-degree GMs (e.g. GOCE-based GMs) may give new for studying the Earth's gravity field.

REFERENCES

[1] Helmert, F. R. Die Mathematischen und Physikalischen Theorieen der H¨oheren Geodäsie (Mathematical and Physical Theories of Higher Geodesy) (in German). Druck und Verlag von B.G. Teubner, Leipzig, Germany, (1880) 626 p.

[2] Plag, H-P., Altamimi, Z., Bettadpur, S., Beutler, G., Beyerle, G., Cazenave, A., Crossley, D., Donnellan, A., Forsberg, R., Gross, R., Hinderer, J., Komjathy, A., Ma, C., Mannucci, A. J., Noll, C., Nothnagel, A., Pavlis,, E. C., Pearlman, M., Poli, P., Schreiber, U., Senior, K., Woodworth, P. L., Zerbini, S., Zuffada, C. The goals, achievements, and tools of modern geodesy. In: Plag H-P, Pearlman M (Eds) Global Geodetic Observing System – Meeting the Requirements of a Global Society on a Changing Planet in 2020. Springer-Verlag, Berlin, Heidelberg, Germany, 2009, pp. 15-87.

[3] Dehant, V. International and national geodesy and its three pillars: (1) geometry and kinematics, (2) earth orientation and rotation, and (3) gravity field and its variability. In: Arijs E, Ducarme B (Eds) Earth Sciences Day of the CNBGG `Geodesy and Geophysics for the Third Millennium´. Belgian Academy of Sciences, 2005, pp. 27-35.

[4] Hildenbrand, T. G., Briesacher, A., Flanagan, G., Hinze, W. J., Hittelman, A. M., Keller, G. R., Kucks, R. P., Plouff, D., Roest, W., Seeley, J., Smith, D. A., Webring, M. Rationale and Operational Plan to Upgrade the U.S Gravity Database. USGS Open-File Report 02-463, 2002.

[5] Smith, D. The GRAV-D Project: Gravity for the Redefinition of the American Vertical Datum. A NOAA contribution to the Global Geodetic Observing System (GGOS) component of the Global Earth Observation System of Systems (GEOSS) Project Plan, 2007, http://www.ngs.noaa.gov/GRAV-D/pubs/GRAV- D_v2007_12_19.pdf (accessed 12 June 2018).

[6] Roman, D.R., Wang, Y.M., Saleh, J., Li, X. Geodesy, Geoids, & Vertical Datums: A Perspective from the U.S. National Geodetic Survey, Facing the Challenges - Building the Capacity. FIG Congress, 11-16 April 2010, Sydney, Australia, 2010.

[7] Li, X., Götze, H. J. Ellipsoid, geoid, gravity, geodesy, and geophysics, Geophysics (2001) 66 (6) 1660-1668.

[8] Barthelmes, F. Global models. In: Grafarend E (Ed) Encyclopedia of Geodesy. Springer International Publishing, Switzerland, 2014, pp.1-9, doi:10.1007/978-3-319-02370-0 43-1.

[9] Reigber, C., Lühr, H., Schwintzer, P. CHAMP mission status, Adv Space Res (2002) 30 (2) 129-134.

[10] Tapley, BD., Bettadpur, S., Watkins, M., Reigber, C. The gravity recovery and climate experiment: mission overview and early results, Geophys Res Lett (2004) 31 L09607.

[11] Floberghagen, R., Fehringer, M., Lamarre, D., Muzi, D., Frommknecht, B., Steiger, C. H., Pineiro, J., da Costa, A. Mission design, operation and exploitation of the gravity field and steady-state ocean circulation explorer mission, J Geod (2011) 85 (11) 749-758.

[12] Godah, W., Szelachowska, M., Krynski, J. On the analysis of temporal geoid height variations obtained from GRACE-based GGMs over the area of Poland, Acta Geophys (2017) 65 713-725.

[13] Novák, P. Direct modeling of the gravitational field using harmonic series, Acta Geodyn Geomater (2010) 7 (1) 35-47.

[14] Bolkas, D., Fotopoulos, G., Braun, A. On the impact of airborne gravity data to fused gravity field models, J Geod (2016) 90 (6) 561-571.

[15] Pavlis, N. K., Holmes, S. A., Kenyon, S. C., Factor, J. K. An earth gravitational model to degree 2160: EGM2008. General Assembly of the

European Geosciences Union, 13-18 April, Vienna, Austria, 2008.

[16] Förste, C., Bruinsma, S. L., Abrikosov, O., Lemoine, J-M., Marty, J. C., Flechtner, F., Balmino, G., Barthelmes, F., Biancale, R. EIGEN-6C4 The latest combined global gravity field model including GOCE data up to degree and order 2190 of GFZ Potsdam and GRGS Toulouse. GFZ Data Services, 2014, doi: 10.5880/ICGEM.2015.1.

[17] Gilardoni, M., Reguzzoni, M., Sampietro, D. GECO: a global gravity model by locally combining GOCE data and EGM2008, Stud Geophys Geod (2016) 60 (2), 228-247.

[18] Hill, P., Bankey, V., Langenheim, V. Introduction to Potential Fields: Gravity. USGS fact sheet, 1997, http://pubs.usgs.gov/fs/fs-0239-95/fs-0239-95.pdf (accessed 12 June 2018).

[19] Hackney, R. I., Featherstone, W. E. Geodetic versus geophysical perspectives of the 'gravity anomaly', Geophys J Int (2003) 154 (1) 35-43.

[20] Mishra, D. C. Gravity anomalies. In: Lastovicka J (Ed) Geophysics and Geochemistry - Volume 3. EOLSS publishers/UNESCO, 2009, pp. 111-136.

[21] Featherstone, W. E., Dentith, M. C. A geodetic approach to gravity data reduction for geophysics, Comput Geosci (1997) 23 (10) 1063-1070.

[22] Hofmann-Wellenhof, B., Moritz, H. Physical Geodesy, 2nd edition. Springer-Verlag, Vienna, Austria, 2006.

[23] Hackney, R. I. Gravity, data to anomalies. In: Gupta HK (Ed) Encyclopedia of Solid Earth Geophysics. Springer, Dordrecht, the Netherlands, 2011, pp. 524-533.

[24] Sjöberg, L. E., Bagherbandi, M. Gravity Inversion and Integration - Theory and Applications in Geodesy and Geophysics. Springer, 2017, doi: 10.1007/978-3-319-50298-4.

[25] Rummel, R., Balmino, G., Johannessen, J., Visser, P., Woodworth, P. Dedicated gravity field missions-principles and aims, J Geodyn (2002) 33 3-20.

[26] Barthelmes, F. Definition of Functionals of the Geopotential and Their Calculation from Spherical Harmonic Models: Theory and Formulas Used by the Calculation Service of the International Centre for Global Earth Models (ICGEM). Scientific Technical Report STR09/02, Revised Edition, January 2013, GeoForschungZentrum Potsdam, 2013, doi: 10.2312/GFZ.b103-0902-26, http://icgem.gfz-potsdam.de/str-0902-revised.pdf (accessed 12 June 2018).

[27] Yilmaz, M., Turgut, B., Gullu, M., Yilmaz, I. The evaluation of high-degree geopotential models for regional geoid determination in Turkey, AKU J Sci Eng (2017) 17 (1) 147-153.

[28] Pavlis, N. K., Holmes, S. A., Kenyon, S. C., Factor, J. K. The development and evaluation of the Earth Gravitational Model 2008 (EGM2008), J Geophys Res (2012) 117 B04406, doi: 10.1029/2011JB008916.

[29] Morelli, C., Gantar, C., Honkasalo, T., McConnell, R. K., Tanner, J. G., Szabo, B., Uotila, U., Whalen, C. T. The International Gravity Standardization Net 1971 (IGSN71). International Association of Geodesy, Special Publication No. 4, 1974.

[30] Yilmaz, M., Gullu, M. A comparative study for the estimation of geodetic point velocity by artificial neural networks, J Earth Syst Sci (2014) 123 (4) 791-808.

[31] Karpik, A. P., Kanushin, V. F., Ganagina, I. G., Goldobin, D. N., Kosarev, N. S., Kosareva, A. M. Evaluation of recent Earth's global gravity field models with terrestrial gravity data Contrib Geophys Geod (2016) 46 (1) 1-11.

[32] Barthelmes, F., Köhler, W. International Centre for Global Earth Models (ICGEM), The Geodesists Handbook 2016, J Geod (2016) 90 (10) 907-1205, doi: 10.1007/s00190-016-0948-z.

[33] Pavlis, N. K., Factor, J. K., Holmes, S. A. Terrain-related gravimetric quantities computed for the next EGM, Proceedings of the 1st International Symposium of the International Gravity Field Service, J Mapp (Special Issue) (2007) 18 318-323.

Comparison of Data Reduction Algorithms for Image-Based Point Cloud Derived Digital Terrain Models

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Abstract—Digital Terrain Model (DTM) is a digital numerical representation of the Earth's surface. DTM's have been applied to a diverse field of tasks, such as urban planning, military, glacier mapping, disaster management. In the expression of the Earth' surface as a mathematical model, an infinite number of point measurements are needed. Because of the impossibility of this case, the points at regular intervals are measured to characterize the Earth's surface and digital terrain model of the Earth is generated. Hitherto, the classical measurement techniques and Photogrammetry method have widespread use in the construction of digital terrain models. At present, RADAR, LiDAR, and stereo satellite images are also used for the construction of digital terrain models. In recent years, especially because of its superiorities, LiDAR has an increased use in DTM applications. A 3D point cloud is created with LiDAR technology by obtaining numerous point data. However recently, by the development in image mapping methods, the use of unmanned aerial vehicles (UAV) for photogrammetric data acquisition has increased during image-based point cloud digital terrain model production is common. The accuracy of the digital terrain models depends on various factors such as data collection method, the distribution of elevation points, the point density, the properties of the surface and interpolation methods.

In this study, the random data reduction method is compared for DTMs generated from image based point cloud data. The original image based point cloud data set (100%) is reduced to a series of subsets by using random algorithm, representing the 75, 50, 25 and 5 per cent of the original image based point cloud data set. Over the ANS campus of Afyon Kocatepe University as the test area, DTM constructed from the original image based point cloud data set is compared with DTMs interpolated from reduced data sets by Kriging interpolation method. The results show that the random data reduction method can be used to reduce the image based point cloud datasets to 50% density level while still maintaining the quality of DTM.

Keywords—DTM, Unmanned Aerial Vehicle (UAV), Random, Kriging.

I. INTRODUCTION

A digital terrain model (DTM) is a representation of the bare earth surface in 3D space that contains elevations of topography. DTMs have been used in all geoscience tasks: civil planning, mine engineering, military purposes, landscape design, urban planning, environmental protection, forest characterization, hydrology, visibility analysis, surface modelling, topographic change, volume computation, geomorphological extraction, satellite imagery interpretation, cartographic presentation, and geographical analysis [1]. DTMs can be derived by field surveying, Photogrammetry or cartographic digitization of existing topographic maps. Compared to the traditional methods for creating DTMs, new technologies (i.e. airborne laser scanning) revolutionize the construction of high quality DTMs [2]. The airborne Light Detection and Ranging (LiDAR) is becoming the prior data acquisition technique for high-resolution and high-accuracy DTMs over large areas [3,4,5,6,7]. For constructing DTMs while preserving high frequencies of the relief, the airborne LiDAR has become a well-established source used in enhancing spatial knowledge of the topography.

Unmanned aerial vehicle (UAV), has appeared as a low-cost alternative to the traditional photogrammetric system for an data acquaring. It is also very effective for obtaining image based point cloud production. UAV is an alternative data source for point cloud [8]. Some UAV based studies can be found in [9,10,11,12,13]

The accuracy of DTMs relies on several factors: (i) the accuracy, the density, and the spatial distribution of elevation points, (ii) the interpolation methods, (iii) the terrain surface characteristics [14,15,16]. There has been a great number of literature about these factors: the accuracy of data acquisition [17,18]; the data density [2,19,20,21,22]; the interpolation process [23,24]; the terrain features [25,26].

II. STUDY AREA

The study area is located at Afyon Kocatepe University in Turkey (Figure 1). Unmanned Aerial Vehicle (DJI Phantom 4 pro) with a overlap 80% from a fly height of 120 m 274 vertical aerial photographs were taken. The ground sampling distance (GSD) of the photographs is 3.27 cm. The captured photos were evaluated in Pix4D software and a 3D point cloud was created.
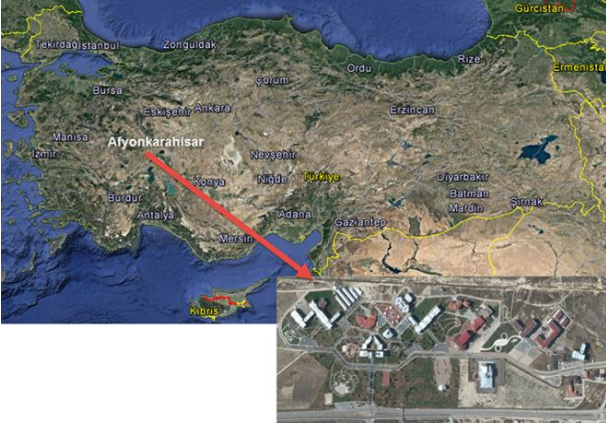
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Fig. 1 The study area.

III. MATERIAL AND METHODS

The primary objective of process is producing 3D point cloud by overlapping aerial image data [27]. The point cloud generation from images is called as Structure from Motion (SfM). 274 aerial photo was evaluated in Pix4D software. After data processing, 42776508 points were obtained with a density of 86.76 (points/m2) (Figure 2).
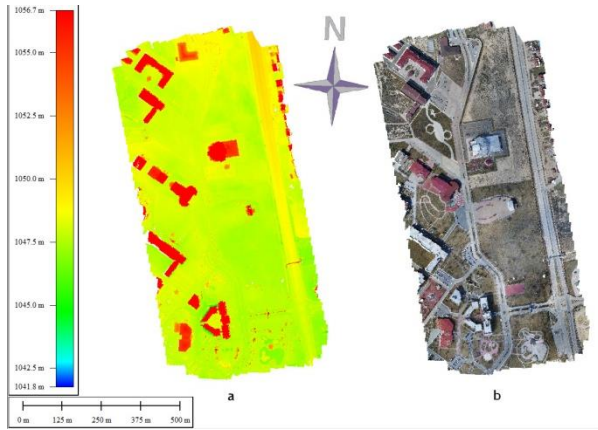

Fig. 2 Image based point cloud,
a) Colorized by elevation point cloud
b) True color point cloud

The Cloth Simulation Filtering (CSF) algorithm is used for the producing of DTM from point cloud [28]. In this study, we used the CSF algorithm for filtering UAV based point clouds. After the filtering process, 34874515 points were detected as ground point data set (Figure 3). Afterward, data reduction processes were done with CloudCompare© software to the ground point data set.

Fig. 3 Point cloud filtered by CSF. (Ground point)

For evaluating the data reduction algorithms on DTM accuracy and to explore the data reduction extent for adequate DTM accuracy; the data density is sequentially reduced. The ground points data set (100%) is reduced to a series of subsets by using random data reduction algorithms: 75%, 50%, 25%, and 5% of the ground point data set. This reduction protocol is similar to the previous studies of [29,30]. Subsequent to the data reduction, the ground point data set and the reduced data sets are used to produce a series of DTMs. DTMs are constructed via KRIGING method [2].

The evaluation of DTM accuracy is focused on the correspondent elevation differences between the reference DTM and the test DTMs using the equation below:

$$\Delta Z = Z_{(100\%)} - Z_{(i\%)} \tag{1}$$

where ΔZ is the elevation difference, Z is the elevation value estimated from (reference and test) DTMs, and i represents the data density (i = 75, 50, 25 and 5) [2].

For the analysis of elevation differences, minimum and maximum values of ΔZ are determined and the overall performance of DTMs is evaluated through ME, MAE, and RMSE accuracy measures:

$$ME = \frac{1}{n} \sum_{k=1}^{n} \Delta Z \tag{2}$$

$$MAE = \frac{1}{n} \sum_{k=1}^{n} |\Delta Z| \tag{3}$$

$$RMSE = \sqrt{\frac{1}{n} \sum_{k=1}^{n} (\Delta Z)^2} \tag{4}$$

where n is the number of the points used for the accuracy

verification and k refers to the residual sequence. ME is a measure of underestimation or overestimation the true value of the interpolation method. MAE provides the average deviation that DTM deviates from the true value to measure the effect of the data reduction on DTM accuracy. RMSE is calculated to determine the overall accuracy of DTM surface [2].

IV. COMPARATIVE STUDY

For the comparison process, the reference DTM of the study area, is constructed from the original (100%) UAV based point cloud dataset using KRIGING by Surfer© 13. The interpolation parameters (for the reference DTMs) are optimized through cross-validation technique [2].

The reduced data sets, based on random algorithms, are used to construct the test DTMs with KRIGING method, at each data density level (75%, 50%, 25% and 5%). The test DTMs (DTMi%; i = 75, 50, 25 and 5) are subtracted from the corresponding reference DTMs (DTM100%) for elevation differences. The graphical representations have been used for the comparative evaluation by residual map for each test DTM (Figure 4)
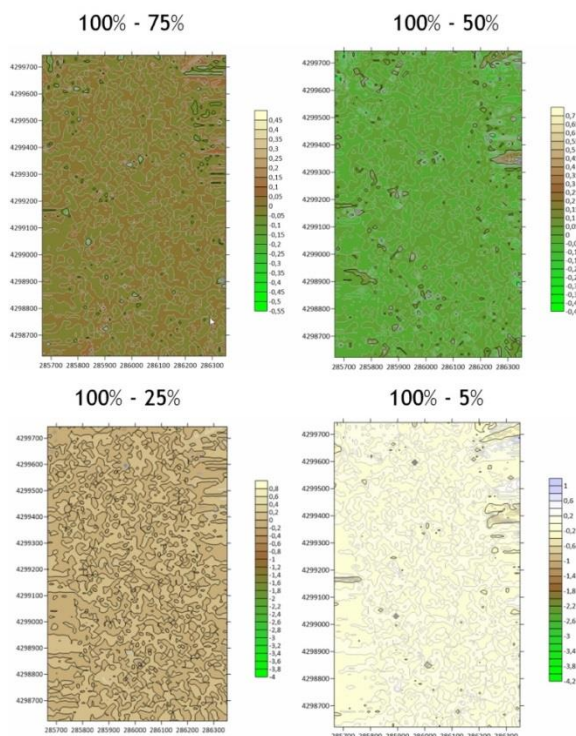

Fig. 4 Residual maps of test DTMs for the study area.

V. RESULTS AND CONCLUSIONS

The elevation residual maps (Fig. 4) indicates that the deviation of the test DTMs from the reference DTM is getting greater due to the decreasement of data density, for random data reduction algorithms. The statistics of elevation residuals based on random algorithms at selected data density levels are presented in Table 1.

MEs is recorded at the centimeter level at 5% data density for random data reduction algorithm (-0.010m). MEs are sub-centimeter at 25%, 50% and 75% data, showing that interpolation biases were negligible.

TABLE I
THE STATISTICS OF THE ELEVATION RESIDUALS (UNITS IN M.)

	RANDOM			
	75%	50%	25%	5%
Min	-0.531	-0.450	-3.933	-4.028
Max	0.429	0.657	0.630	0.840
ME	0.001	-0.004	-0.003	-0.010
MAE	0.015	0.026	0.038	0.064
RMSE	0.033	0.052	0.086	0.128

Throughout the decreasing data densities, the test DTMs have increasing MAEs ranged from 0.015 m to 0.064 m. show significant increases for random data reduction algorithms as data densities decreased from 75% to 5%.

RMSEs ranged from 0.033 m. to 0.128 m. show significant increases as data densities decreased from 75% to 5%. As expected, the lowest RMSEs are obtained at 75% data density level.

In terms of overall accuracy, there is no considerable decrease for the test DTMs constructed from high data densities (75% and 50%) (Fig. 4). Therefore, it becomes certain that the test DTMs based on 75% and 50% point densities are adequate.

As a result of the application, DTM was generated from point clouds of different intensity according to a random data reduction algorithm. In the DTMs produced at 25% and 5% density, the maximum and minimum impact of the contradictions occurred. This is due to the stage of obtaining and filtering the point cloud.

The UAV based point cloud is one of the most capable, effective, and reliable tool for collecting high-accuracy and high-density 3D terrain data leading to mapping products. UAV based data can be used for DTM generation by photogrammetric techniques. The limitations of the use of. Image-based point clouds depend on the quality of the photo. However, high-density data associated with an image based lead to imposing challenges with respect to data storage, processing and manipulation. Big data volumes require data reduction without losing relevant geometric details while constructing DTMs. The data should be reduced by keeping critical data. In order to represent the terrain with the reduced data, future researches using different data reduction algorithms are essential for determining adequate data reduction algorithm and the threshold data density for DTM generation.

REFERENCES

[1] Li, Z., Zhu, C., Gold, C. Digital Terrain Modeling: Principles and Methodology. (2005). Boca Raton: CRC Press.
[2] Yılmaz, M., Uysal, M., A Comparative Study Of Curvature And Grid Data Reduction Algorithms For Lidar-Derived Digital Terrain Models. Proceedings, 6 th International Conference on Cartography and GIS, 13-17 June 2016, Albena, Bulgaria
[3] Ma, R., Meyer, W. DTM generation and building detection from LiDAR data. Photogrammetric Engineering and Remote Sensing, (2005). 71, 847-854.

[4] Liu, X., Zhang, Z. LiDAR data reduction for efficient and high quality DEM generation, The International Archives of the Photogrammtery, Remote Sensing and Spatial Information Sciences, (2008). 3, XXXVII, 173-178.

[5] Vianello, A., Cavalli, M., Tarolli, P. LiDAR-derived slopes for headwater channel network analysis. Catena, (2009). 76 (2), 97-106.

[6] Razak, K.A., Straatsma, M.W., van Westen, C.J., Malet, J.P., de Jong, S.M. Airborne laser scanning of forested landslides characterization: Terrain model quality and visualization. Geomorphology, (2011). 126, 186-200.

[7] Yan, W.Y., Shaker, A., El-Ashmawy, N. Urban land cover classification using airborne LiDAR data: A review. Remote Sensing of Environment, (2015). 158, 295-310.

[8] Polat, N., Uysal, M. DTM Generation with Uav Based Photogrammetric Point Cloud. ISPRS - International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, (2017). Volume XLII-4/W6, 2017, pp.77-79.

[9] Eisenbeiss, H., Lambers, K., Sauerbier, M., & Li, Z. Photogrammetric documentation of an archaeological site (Palpa, Peru) using an autonomous model helicopter. (2005). In Proceedings of International CIPA Symposium (pp. 238–243).

[10] Colomina, I., Bla´zquez, M., Molina, P., Pare´s, M. E., & Wis, M. Towards a new paradigm for high-resolution low-cost photogrammetry and remote sensing. (2008). In Proceedings of XXIst ISPRS congress: Technical commission I (pp. 1201).

[11] Remondino, F., Barazzetti, L., Nex, F., Scaioni, M., & Sarazzi, D. U.AV photogrammetry for mapping and 3d modeling–current status and future perspectives. (2011). In Proceedings of the international archives of the photogrammetry, remote sensing and spatial information sciences, Volume XXXVIII-1/C22 (pp 25–31).

[12] Uysal, M. Toprak, A.S.; Polat, N. DEM generation with UAV Photogrammetry and accuracy analysis in Sahitlerhill. (2015). Measurement 2015, 73, 539–543.

[13] Polat, N., Uysal, M., An Experimental Analysis of Digital Elevation Models Generated with Lidar Data and UAV Photogrammetry. (2018). Journal of the Indian Society of Remote Sensing 46(7):1135–1142

[14] Gong, J., Li, Z., Zhu, Q., Sui, H., Zhou, Y. Effects of various factors on the accuracy of DEMs: an intensive experimental investigation. Photogrammetric Engineering and Remote Sensing, (2000). 66 (9), 1113-1117.

[15] Chen, C.F., Yue, T.X. A method of DEM construction and related error analysis. Computers and Geosciences, (2010).36 (6), 717-725.

[16] Sailer, R., Rutzinger, M., Rieg, L. Wichmann, V. Digital elevation models derived from airborne laser scanning point clouds: appropriate spatial resolutions for multi-temporal characterization and quantification of geomorphological processes. Earth Surface Processes and Landforms, (2014). 39 (2), 272-284.

[17] Rayburg, S., Thoms, M., Neave, M. A comparison of digital elevation models generated from different data sources. Geomorphology, (2009). 106, 261-270.

[18] Dorn, H., Vetter, M., Höfle, B. GIS-based roughness derivation for flood simulations: a comparison of orthophotos, LiDAR and crowdsourced geodata. Remote Sensing, (2014). 6, 1739-1759.

[19] Aguilar, F.J., Agüera, F., Aguilar, M.A., Carvajal, F. Effects of terrain morphology, sampling density and interpolation methods on grid DEM accuracy. Photogrammetric Engineering and Remote Sensing, (2005). 71 (7), 805-816.

[20] Chaplot, V., Darboux, F., Bourennane, H., Leguédois, S., Silvera, N., Phachomphon, K. Accuracy of interpolation techniques for the derivation of digital elevation models in relation to landform types and data density. Geomorphology, (2006). 77, 126-141.

[21] Yılmaz, M., Uysal, M., Comparing Uniform And Random Data Reduction Methods For DTM Accuracy. International Journal of Engineering and Geosciences (IJEG), (2017).Vol;2, Issue;01, pp. 9-16

[22] Yılmaz, M., Uysal, M., Comparison of data reduction algorithms for LiDAR- derived digital terrain model generalization. Area. (2016). 48(4):521–532

[23] Chen, C., Li, Y. A robust method of thin plate spline and its application to DEM construction. Computers and Geosciences, (2012). 48, 9-16.

[24] Arun, P.V. A comparative analysis of different DEM interpolation methods. The Egyptian Journal of Remote Sensing and Space Sciences, (2013). 16, 133-139.

[25] Aguilar, F.J., Aguilar, M.A., Agüera, F. Accuracy assessment of digital elevation models using a non-parametric approach. International Journal of Geographical Information Science, (2007). 21 (6), 66-686.

[26] Chu, H.J., Chen, R.A., Tseng, Y.H., Wang, C.K. Identifying LiDAR sample uncertainty on terrain features from DEM simulation, Geomorphology (2014).204, 325-333.

[27] Siebert, S. Teizer, J. Mobile 3D mapping for surveying earthwork projects using an Unmanned Aerial Vehicle (UAV) system. Autom Constr. (2014). 1–14.

[28] Zhang, W., Qi, J., Wan, P., Wang, H., Xie, D., Wang, X., and Yan, G. An easy-to-use airborne lidar data filtering method based on cloth simulation. Remote Sensing, (2016). 8(6).

[29] Anderson, E.S., Thompson, J.A., Austin, R.E. LIDAR density and linear interpolator effects on elevation estimates. International Journal of Remote Sensing, (2005). 26 (18), 3889-3900.

[30] Anderson, E.S., Thompson, J.A., Crouse, D.A., Austin, R.E. Horizontal resolution and data density effects on remotely sensed LIDAR-based DEM. Geoderma, (2006). 132 406– 415.

Segmentation and Classification of Urban Point Clouds

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Abstract—Today, developments in technology provide important advantages in obtaining data. In this case, the processing and classification of overproduced data has become important. Today, Lidar and image-based systems are widely used in 3D data generation. Especially in recent years, the use of unmanned aerial vehicles has led to a significant increase in both image-based and laser-based point cloud production. Laser scanners, which are an active detection system, collect much data on the surface and create 3D point clouds. Image-based point clouds are widely used in recent years due to the development of image mapping methods and the use of Unmanned Aerial Vehicles for photogrammetric data acquisition. The need for 3D models and point clouds is increasing day by day. In scientific studies, it is important to produce the models that need a lot of different areas until the game world. the classification and classification of the 3D point clouds required for this is the work that needs to be done firstly. In this study, the classification of point cloud 3b will be done. The algorithms used for this will be determined and analyzed. The classification of 3D point clouds is one of the main research topics in photogrammetry, remote sensing and computer vision. Autonomous processing of excess data collected today will provide speed and economy. Besides the speed of processing these data, it is more important to process them correctly. The goal of this work is to analyze the most popular methodologies and algorithms for segmenting and classifying 3D point clouds into segments.

Keywords—3D point clouds, segmentation, classification, UAV, LiDAR.

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Determination of Surface Deformations with Global Navigation Satellite System Time Series

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Abstract—The development of Global Navigation Satellite System (GNSS) technology has led to increasingly widely and successful applications of GNSS surveys for monitoring crustal movements. Instead of the multi-period GNSS solutions, this study utilizes GNSS time series that are required to more precisely determine the vertical deformations in the study area. In recent years, the surface deformations that are parallel and semi-parallel to Bolvadin fault have occurred in Western Anatolia. These surface deformations have continued to occur in Bolvadin settlement area that is located mostly on alluvium ground. Due to these surface deformations, a number of cracks in the buildings located in the residential areas and breaks in underground water and sewage systems have been observed. In order to determine the amount of vertical surface deformations, two continuous GNSS stations have been established in the region. The stations have been operating since 2015 and 2017, respectively. In this study, GNSS observations from the mentioned two GNSS stations were processed with GAMIT/GLOBK (GNSS Analysis Massachusetts Institute of Technology/GLOBal Kalman) program package to create coordinate time series. With the time series analyses, the GNSS stations' behaviour models (linear, periodical, etc.), the causes of these behaviours, and mathematical models were determined. The study results from the time series analysis of these two 2 GNSS stations show approximately 50-90 mm/yr vertical movement.

Keywords—Bolvadin fault, GAMIT, GNSS time series, surface deformations.

I. INTRODUCTION

THE term of GNSS is generally used to describe a satellite constellation which provides geo-spatial position of any location in the world. In recent years, Continuously Operating Reference Station (CORS) networks that provide GNSS data to support the positioning applications have been widely used in many developed countries. A satellite navigation system is a system of satellites that enables small electronic receivers to determine their three dimensional positions within a few meters using the radio time signals from the satellites. The precisely determined position of the receivers can be used as a reference for civil, industrial, scientific, and military applications [1]. Nowadays, GNSS can be used as a positioning tool ranged from smart phones, airplanes to cars for the commercial areas and the determination and monitoring the crustal deformations along with various other applications for the scientific areas [1].

The development of GNSS measurement systems have been in advantage of not only the geodesy but also earth sciences. Starting from 1980's, GNSS has been rapidly favored of the conventional measurement techniques. Especially, crustal deformation monitoring with GNSS study has been one of the most popular topics for the researchers in many areas of the earth sciences [2-6]. Earthquakes are one of the major natural events due to the crustal deformation. The studies on the prediction of the earthquakes have increased during the last century. It is possible to predict the possible location, not occurrence time, of the earthquake by computing the stress concentration on the seismic faults if where the observations are obtained through the deformation measurement instruments [4,6,7].

The GNSS measurements can determine three-dimensional crustal deformation, but the accuracy of vertical positioning is much lower than that of horizontal components, due to the effect of atmospheric refraction and uncertainties in the antenna phase center of GNSS satellites and receivers. However, vertical deformations can be determined by continuously GNSS survey solutions [6,8,9].

Study area is located in the Western Anatolia. Western Anatolia is one of the most important seismogenic zones in Turkey. The study area has a major tectonic structure that consist of Aksehir-Sultandagi Fault Zone (ASFZ), Fethiye-Burdur Fault Zone (FBFZ), and Isparta Angle (IA) [10]. ASFZ have caused the formation of the grabens, from Southeast to Northwest, in Afyon-Aksehir [11]. The earthquake records from the historical and instrumental periods suggest the existence of a large number of earthquakes created the surface ruptures in this zone. On the date of 03.02.2002, this region has been shaken by the earthquakes with Mw 6.5 and Mw 6.2 in size. The epicentres were located Bolvadin and the southern Eber Lake (Fig. 1). The surface deformations have been observed for last five-year even though there not any destructive earthquakes observed in Bolvadin settlement. During the field studies in Bolvadin area, progressive surface deformations such as surface faults and earth fissures whose length varies between 300 meters and 2 kilometers and strike varies between N15°E and N70°E are mapped. The northernmost one of the surface deformations mapped in the settlement area of Bolvadin has the characteristics of the southwestern continuation of Bolvadin Fault [12].

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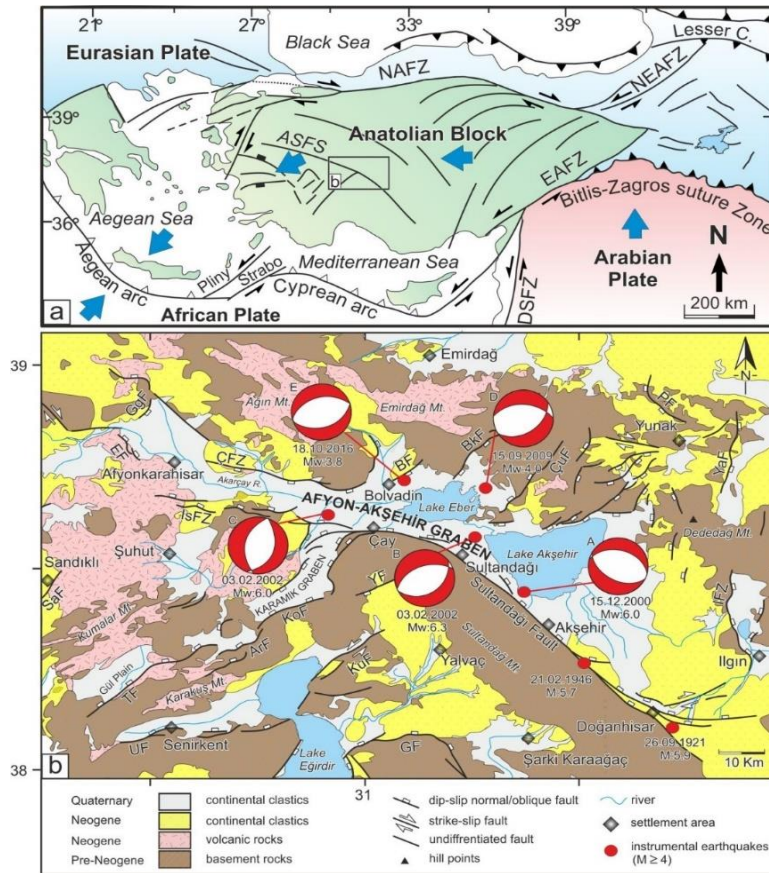
Fig. 1. a) Tectonic outline of the eastern Mediterranean area (compiled from [13] and [14]). Abbreviations: ASFS, Akşehir-Simav Fault System; DSFZ, Dead Sea Fault Zone; EAFZ, East Anatolian Fault Zone; NAFZ, North Anatolian Fault Zone; NEAFZ, Northeast Anatolian Fault Zone. b) The geology map of AAG and its immediate vicinity (compiled from [15-17]) Abbreviations: ÇFZ: Çobanlar Fault Zone; IsFZ: Işıklar Fault Zone; BF: Bolvadin Fault; BkF: Büyük Karabağ Fault; ÇuF: Çukurcak Fault; YF: Yarıkkaya Fault; KuF: Kumdanlı Fault; GF: Gelendost Fault; KoF: Kocbeyli Fault; ArF: Arızlı Fault; UF: Uluborlu Fault; TF: Tatarlı Fault.
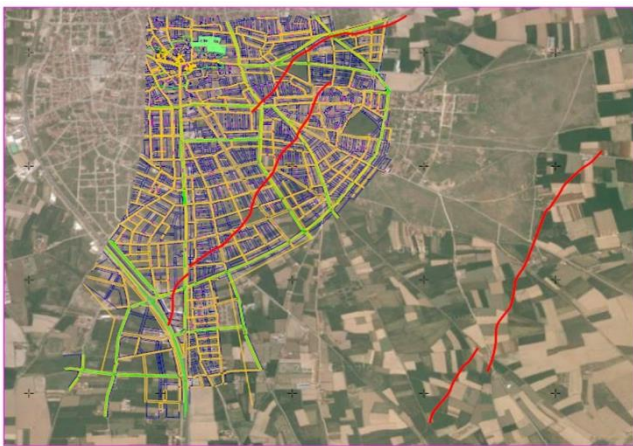
Fig. 2. The surface deformations which are parallel and semi-parallel to Bolvadin fault

Some of the buildings in the linear deformation zone, such as houses, schools, and medical centres have deformed critically, and most have been evacuated. In addition, these deformations have also damaged the underground water, gas or the sewage network in the urban areas of Bolvadin (Fig. 3).
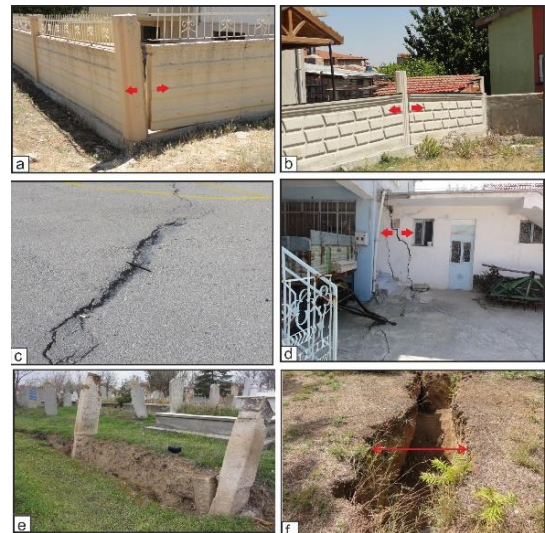

Fig. 3. The Surface deformations observed within the Bolvadin settlement area. a-b) The divergence of garden walls of some buildings located on the surface fault near the Park Akcan, c) Linear deformations on asphalt pavement of the school garden, d) Extensional cracks in some buildings located on the surface fault, e- f) Deformations on graves

In this study, the vertical deformation in Bolvadin settlement was determined based on continuously GNSS measurements. Two new continuously GNSS stations established in the region where the surface deformations are

active (Bolvadin).

II. GNSS OBSERVATIONS AND TIME SERIES

Two continuously operating GNSS stations were established to determine the temporal behavior of surface deformations occurring in the Bolvadin fault. The first GNSS station was established in January 2015 and was named AKTC. This station was located about 500 meters to the surface deformations. The second GNSS station that named BLV1 was established in June 2017 and located near the surface deformations. The energy needs of each of the 2 stations were supported by solar panels and they were able to make continuous measurements as shown in Fig. 4.

Fig. 4. The GNSS stations of AKTC (A) and BLV1 (B)

All GNSS data were processed using the GAMIT (GPS Analysis)) /GLOBK (GLOBal Kalman) software developed by Massachusetts Institute of Technology. The GAMIT module can estimate 3D coordinates, satellite orbits, atmospheric zenith delays and earth rotation parameters using carrier phase measurements and pseudo-range observations. During the analysis, L3, the ionosphere-independent linear combination of the L1 and L2 carrier waves, was used. The FES2004 OTL grid allowed interpolating the Ocean Tide Loading (OTL) components from a global grid [17-20]. The coordinates obtained by GAMIT software were used in the time series starting with the first measurement taken (2015.1). The linear (trend), periodic, and irregular (stochastic) movements of the reference stations can be determined by time series analysis. For the North, East, and Up coordinates of the reference stations, the times series of $\bar{x}(t_i)$ depending on the time of t_i $(i = 1, 2, 3, ..., N)$ can be expressed as follows [21, 22].

$$\bar{x}(t_i) = \underbrace{\sum_{k=1}^{m} a_k t_i^{k-1}}_{trend\,component} + \underbrace{\sum_{s=1}^{r}\left[b_s\cos(2\pi f_s t_i) + c_s\sin(2\pi f_s t_i)\right]}_{periodic\,component} +$$

$$\underbrace{\sum_{j=1}^{p}\alpha_j\bar{x}(t_{i\,j}) + \sum_{jj=1}^{q}\beta_{jj}v(t_{ijj})}_{Stochastic\,component} + \underbrace{v(t_i)}_{resudial}$$

(1)

Where, a_k: Trend component parameters, b_s, c_s: Periodic component parameters, f_s: Frequency, α_j: Auto-regressive (AR (p)) model parameters, β_{jj}: Average Movement (MA (q)) model parameters, $v(t_i)$: Random errors with the

Average zero and variance σ^2.

Other mathematical applications can be found in [1 and 22]. With the help of application written in the MATLAB environment, time series of height components of AKTC and BLV1 stations have been analyzed and given in Fig. 5.
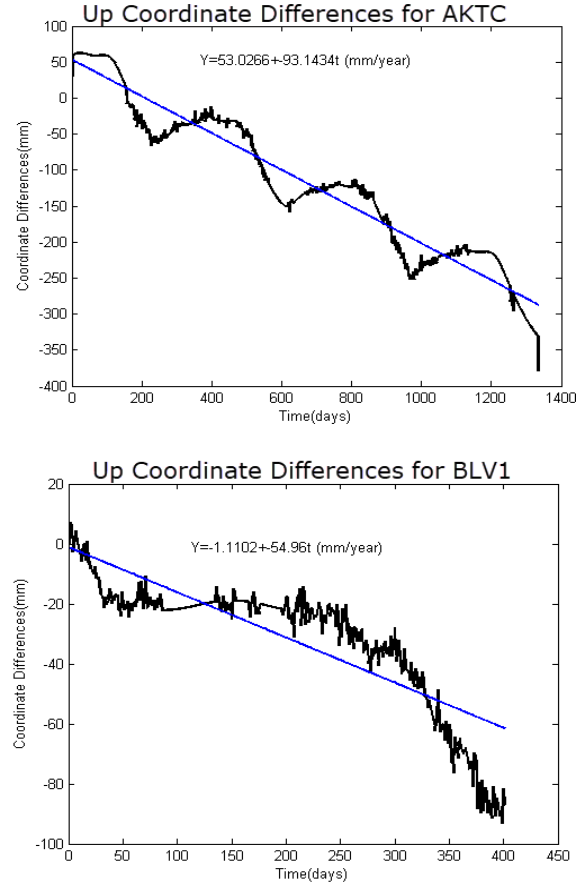

Fig. 5. The Time series of up coordinate differences of AKTC and BLV1 GNSS stations

III. RESULTS AND CONCLUSIONS

Two GNSS stations have been installed to monitor vertical deformations in the region. AKTC station collected approximately 1300 days and BLV1 collected 400 days of GNSS data. All GNSS data were processed using the GAMIT/GLOBK software to create the time series.

When Figure 5 is examined, the vertical deformation is calculated at approximately 55 mm / year at BLV1 station and 93 mm / year at ACTC station. Based on the studies conducted in the region, it has been observed that in the last 20 years, as a result of intensive agricultural irrigation, the groundwater levels have decreased by 5-15 m.

The main reason for the deformations occurring in the region is thought to be decreases in ground water levels. However, the occurrence of deformations in the extension of a fault line indicates that this situation is originated from a tectonic formation. Therefore, extensive geodetic and geological studies were initiated in the region. In addition to the GNSS points, the leveling points were also established and observations were started.

ACKNOWLEDGMENT

the project numbered 115Y246 and supported by Afyon Kocatepe University's project numbered 18.KARİYER.167.

REFERENCES

[1] Gülal, E., Erdoğan, H., & Tiryakioğlu, İ.. Research on the stability analysis of GNSS reference stations network by time series analysis. Digital Signal Processing, (2013), 13(8), 1945-1957.

[2] McClusky, S., Balassanian, S., Barka, A., Demir, C., Ergintav,S., Georgiev, I., Gurkan, O., … Veis, G., Global Positioning System constraints on plate kinematics and dynamics in the eastern Mediterranean and Caucasus. Journal of Geophysical Research-Solid Earth, (2000), 105, 5695–5719. doi:10.1029/1999jb900351.

[3] Reilinger, R., McClusky, S., Vernant, P., Lawrence, S., Ergintav,S., Cakmak, R., … Karam, G., GPS constraints on continental deformation in the Africa-Arabia-Eurasia continental collision zone and implications for the dynamics of plate interactions. Journal of Geophysical Research, (2006), 111, B05411.

[4] Tiryakioglu, I., Floyd, M., Erdogan, S., Gulal, E., Ergintav, S., McClusky, S., & Reilinger, R., GPS constraints on active deformation in the Isparta Angle region of SW Turkey. Geophysical Journal International, (2013), 195, 1455–1463.

[5] Tiryakioglu, I., Yigit, C. O., Yavaşoglu, H., Saka, M. H., & Alkan,R. M., The determination of interseismic, coseismic and postseismic deformations caused by the Gökçeada-Samothraki earthquake (2014, Mw: 6.9) based on GPS data.journal of African Earth Sciences, (2017), 133 (2017), 86–94.

[6] Qin, S., Wang, W., and Song, S., Comparative study on vertical deformation based on GNSS and leveling data, Geodesy and Geodynamics, (2018), 9 (2), 115-120.

[7] Tiryakioglu, I., Geodetic aspects of the 19 May 2011 Simav earthquake in Turkey. Geomatics. Nat. Hazards Risk, (2015), 6 (1), 76e89.

[8] Milne, G.A., J.X. Mitrovica, H.-G. Scherneck, J.L. Davis, J. M. Johansson, H. Koivula and M. Vermeer., Continuous GPS measurements of postglacial adjustment in Fennoscandia: 2. Modeling results, Journal of Geophysical Research, (2004), volume 109, DOI: 10.1029/2003JB002619

[9] Mäkinen, J., H. Koivula, M. Poutanen, V. Saaranen, Vertical Velocities in Finland from Permanent GPS Networks and from Repeated Precise Levelling. Journal of Geodynamics, (2003), Vol 35, No.4-5, pp. 443-456.

[10] Blumenthal, M.M., Le système structural du Taurus sud Anatolies. Bull. Soc. Géol. Fr. In: Livre à Mémoire de Professor P. Fallot. Mém. Soc. Géol. Fr. 1963, 1, 2, 611–662.

[11] Koçyiğit, A., Bozkurt, E., Kaymakçı, N. ve Şaroğlu, F., 3 Şubat 2002 Çay (Afyon) Depreminin Kaynağı ve Ağır Hasarın Nedenleri: Akşehir Fay Zonu, ODTÜ Tektonik Araştırma Birimi Ön Raporu, 2002, 19 s. [Published in Turkish]

[12] Özkaymak Ç., Sözbilir, H., Tiryakioğlu, İ. ve Baybura, T., Geologic, Geomorphologic and Geodetic Analysis of Surface Deformations Observed in Bolvadin (Afyon-Akşehir Graben, Afyon). Geological bulletin of Turkey, (2017), 60, 169-188

[13] Kaymakcı, N., Kinematic development and paleostress analysis of the Denizli Basin (Western Turkey): Implications of spatial variation of relative paleostress magnitudes and orientations. Journal of Asian Earth Sciences, (2006), 27, 207–222.

[14] Özkaymak, Ç., Tectonic analysis of the Honaz Fault (western Anatolia) using geomorphic indices and the regional implications. Geodinamica Acta, (2015), 27 (2-3), 110-129.

[15] Turan, N., Geological map of Turkey in 1:500.000 scale: Ankara sheet.Publication of Mineral Research and Explaniton Direction of Turkey (MTA), (2002), Ankara..

[16] Emre, Ö., Duman, T. Y., Özalp, S., Olgun, Ş. ve Elmacı,H., 1:250.000 scale active fault map series of Turkey, Afyon (NJ 36-5) Quadrangle. Serial number: 16, General Directorate of Mineral Research and Exploration, (2011), Ankara, Turkey.

[17] Tiryakioğlu, İ., Özkaymak, Ç., Baybura, T., Sözbilir, H., Uysal, M., Comparison of Palaeostress Analysis, Geodetic Strain Rates and Seismic Data in the Western Part of The Sultandağı Fault in Turkey. Annals of Geophysics, (2018), 61, 3, GD335. Doi: 10.4401/ag-7591.

[18] Lyard, F., Lefevre, F., Letellier, T. & Francis, O., Modelling the global ocean tides: Modern insights from FES2004. Ocean Dynamics, (2006), 56 (5-6), 394-415. doi:10.1007/s10236-006-0086-

[19] Herring, T.A., King, R.W. and Mcclusky, S.C., Introduction to GAMIT/GLOBK, Release 10.4, MIT, (2010), Cambridge, MA,.

[20] Tiryakioglu, I., Geodetic aspects of the 19 May 2011 Simav earthquake in Turkey. Geomatics. Nat. Hazards Risk, (2015), 6 (1), 76e89..

[21] Gülal, E., Dindar, A.A., Akpınar, B., Tiryakioğlu, I., Aykut, N.O., Erdoğan, H., Analysis And Management Of Gnss Reference Station Data, Technical Gazette, (2015), 22, 2, 407-414

[22] Tiryakioğlu, I., Yavaşoğlu, H., Uğur, M.A., Özkaymak, Ç., Yılmaz, M., Kocaoğlu, H., Turgut, B. Analysis of October 23 (Mw 7.2) and November 9 (Mw 5.6), 2011 Van Earthquakes Using Long-Term GNSS Time Series, Earth Science Research Journal, (2017), 21, (3), 147-156.

The Analysis of Space Element in Architecture and Music and It's Role in Children's Creativity

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Abstract
This study defines art and space in architecture and music and its relationship with children's creativity. Architecture and music have a significant role in this process. This research tried to determine the effects of the two arts on the children's creativity and growth. The research used a questionnaire and field studies as the instruments of the study. Participants of the study were 50 children aged between 3 to 8 years old with the same level of life conditions and parents' education. Results show that music and changes in completeness of its' space, architecture and flexibility of its' elements in the formation of space and even intervention and openness and closeness can improve children's' motivation, creativity, intelligence and learning.

Keywords: architecture, music, space, children's creativity

Introduction
A lot of research has been conducted on the factors affecting the children's growth and personality and educational methods and issues; however, the effect of architectural space and music on fostering children's creativity, intelligence and learning is less discussed and taken into consideration. Research shows that the best time to grow and develop capabilities of creativity in children is ranged from 2 to 10 years old when children are highly affected by the surroundings and spaces dominated on them. Yet, educational spaces intended for children in Iran is mainly residential spaces that have been transformed into children's educational context through painting and colors. Therefore, this study aims to investigate the role of the two effective elements of architecture and music that improve children's creativity and motivation for growth and learning.

What is art?
Art is the representation and aspect of the world and the expression means of emotions and affections. In other words, art is a meaningful or indicative form. Art is created through which one can feel life. Tolstoy's opinion on artistic issues is that the artistic topics are important just because it is understandable for everyone. [1]
The English contemporary cognoscente, Herbert Reed states that original nature of cannot be found in building objects that respond to practical needs life or in indicating religious or philosophical concepts but it can be observed by the ability of the artist for the comprehensive and substantive creation that is not the world of practical need and desires and imaginary world but is a comprehensive world of conflicts; that is a compelling picture of the whole experience and consequently individual's perception of the aspect of overall truth. According to "Herbert Read," art is a distinctive effort that is affected by material conditions like all the effort but entails an aspect of knowledge of reality and at the same time its goal. Of course, it is distinct from other reactions such politics and religion, and implies autonomy in the process that is called civilization or culture.
Art has a fundamental link with the element of "beauty", and beauty can be actually called as the sense of understanding heart relationships. On the one hand, the form of the artist 's thought and idea, type of culture and personality determine his attitude to the world and indicate how they perceive beauty.[2]

The artist human being
Human being has always searched tirelessly towards his perfection and wants more than what is existed; he cultivates his imagination and ideas to the farthest parts of the universe, splits each particle to find a world of unknowns, dominates the world and remains restively unsatisfied with what is existed.

Understandable space of human beings
The enriched space results from gathering, adaptation and continuity of individual and collective experiences of music, architecture and art that affect human living space. Space is considered as a fundamental ground of providing human excellent and noble incentives that affects the world of architecture and the music. Emotional-artistic space of individuals influences specific moments in the history of human societies. Tune and space interact each other and can highly adjust to each other.
Space refers to a place and location, emotional and spiritual environment, and atmosphere or position. Creating a kind of emotional and mental space is one of the artist's objectives in all the arts. In architecture, the artist architect like other creators can induce the same emotional and mental impressions by creating different spaces; for example, a musician creates it through sounds and instruments.
Similarly, a music space can induce emotional and mental impressions caused by "Photosphere» or mental audio space full of attraction. As a poem can create a highly mystical and divine space, building a mosque with minarets to the sky and

extension of the sides of a church that seem to perform excellence and rise and can shape atmosphere of spiritual attractions can also induce such impressions. As Lanece Xenakis believes, "whether it is our will, there is a relationship between architecture and music- this is based on our mental structures that are the same in both arts."[3]

In the classification of the arts, architecture is considered as one of the arts, which can be beautiful and useful. "Schopenhauer Schopenhaver» believes that "architecture is a compromise between beauty and profitability." "Goethe" stated that:

"Architecture means a solidated music. [6]

The appearance of the word "space" in the architecture began with Semper's volumetry in Germany at the end of the nineteenth century that was followed by aesthetics views. Then, it was flourished by early modern thought and eventually opened itself with Gideon in the English-speaking world. Consequently, the word "space" entered the everyday vocabulary of architecture.[4]

On the book Words and Buildings: Modern Architecture Vocabulary, Adrian Forty (2000) begins the study of the roots of the space by separating the two schools of thought that emerged in the German philosophy since nineteenth century. The first school focusing on Gottfried Semper (1803-1879) tries to understand architectural theory through Hegel's philosophy rather than architectural tradition. The other school emerged in the 1890s that has a psychological approach to aesthetics though has some relationship with Kant's philosophy.

In the first decade of the twentieth century, Semper was the reference of those modern architects who were first considered "space" as the main subject of architecture. Adolf Loos (1898), Hendrik Petrus Berlage (1905) and Peter Bruns (1910) have articles and theories that knew the enclosed space as the nature and purpose of architecture.

Dual meaning of the word Ram in German that means space and room, and is a closed structural space makes this approach more understandable. Schopenhauer mentions this capability in his notebook on architecture as the World as Will saying that architecture finds its existence at the first place in our spatial sense perception and therefore appeals to that intuitive ability in us that prioritized every experience. In the article of the essence of architectural creation, August Shemasove had written. With his spatial principles, in which the human muscular motion replaced with static figure proportions, Shemasove revived spatial thinking in a query to kinetic relationship of human being with artificial environment. Accordingly, as we perceive our experience and body, a sense of space and spatial imagination lead us to create space, and this could be called architecture. The main feature of abstract space was an objectivist ontology and separation of object from mind.

As a result, architecture was considered the dominant attitude of instrumental era that make social changes by producing abstract space. Complex and interrelated approaches against modern space, such as postmodernism of Neoavangard, theories of "place" and "new space" grew over time. The common feature of most of them was a relational ontology that did not separate space and time and subjectivity and objectivity [7].

"All the arts are going to reach the musical stage" means that our awareness leads us to real recognition of the concept of all arts. The question is: what does mystery exist in the music art that other arts are trying to achieve it?

According to the important principle of "Schopenhauer", it would be the quality of abstraction in the music art. What distinguishes music from other art is immediate expression with audiences, which facilitates conveying the artist's mental messages and ideals and mind and emotions to others, while in architecture, the artist's message must be represented by a means called as shapes structure and understandable lines and colors. Moreover, words convey mental concepts of poets in poem.

In order to create that category of more mystical works towards the world of contents, Beethoven moved from absolute meanings and concepts to tangible and visible objects, and then crossed the way in the opposite direction so that he achieved the highest mastery on the meaning and concepts and created stable and valuable works, which have remained for centuries and generally became the reference of the literature world.

Apparently, as music has different types, architecture is also divided into several types. Certain types of music include religious music, madrigal music and heroic music; each of them are divided into categories such as doxology, elegy, and so on in religious music. Madrigal music, there are lyrical, torch, satire, facetious and folk songs. In heroic music, various patriotic songs can be mentioned. If we want to compare different types of architecture with types of music, the following cases can be referred to:

1. Folk architecture that relies on traditional methods such as folk music that belongs to a community and has different branches.

2. Native architecture that arises from folk architecture and relies on traditions and climate of the specific area or region such as folk music or native music (Musique Indigene).

3. Religious architecture that reflects religious needs of people but is not very diverse.

4. Monumental architecture or monument building that should note social character of the owner of the building in addition to its appearance.

According to the above-mentioned statements, space or environment is the performance stage of a show that has been written by an architect. The more desirable the scene, show and performance, the more beautiful, attractive and eloquent the result of the work will be. In general, it could be said that attention to the symbols is a means to establish the relationship between building and people - as in scientific music that using local themes and folkloric sounds is a means to establish the same kind of emotional and mental relationship with people.

Relationships and ratios between internal and external spatial elements or units make particular perspectives that determine visual characteristics and spiritual values; they identify quantitative components of symbols replaced in architectural space or building components, which has been transformed into a symbol in its unity integrity that is also non-separable. General requirements to re-identify the music include beat (rhythm), tune (melody), harmony and tone or coloring (stamp) that are found in the most reliable sources and there is more or less more equality between the available elements according to

scientific and technical definitions. Or four main elements: height that is usually shown by the seven series, stress or emphasis on songs (rhythmic accent), length (notes at a time) and resonance so that contemporary philosopher, "Galvano del Valie" also states that in our perspective, both architecture (that achieved fewer constituent elements of its creation system, and didn't find an organized efficient intellectual and scientific instrument) and music (which has been known and given in valuable Persian books).

Architecture and music in spatial-temporal space

There is certain similarities, parallelism and symmetry between architecture and music that is worth noting and perhaps maybe useful as the main topic of this paper. As seen earlier, architects deal with tangible and amorphous material and their starting point in the creation of architectural space is how to cut materials that are amorphous masses. And in more abstract sense, musicians have intangible and amorphous material that will have no practical feature if there is no cut in it (as opposed to amorphous stone, plaster and clay).

Both architects and musicians or composers apply cuts on the amorphous material they have. Rock is craved and sound is also cut with color, height and certain length in order to be located adjacent or former sounds. Construction materials that have been given a certain volume and sounds that have been given a certain height, resonance and length, are used for two types of space. The first is intangible but can be measured and can only be understood[6].

Space organization based on the common patterns in architecture and music

In the Iranian architecture and music, space has a template or pattern property. These patterns include four porches, central courtyard and geometric division of surfaces (chess, cross, etc.) in the Iranian architecture. Thus, differences caused by different used are not highlighted. The same pattern characteristic of Persian music and improvisations based on certain melodic patterns may cause that any similarity in sounds and distances caused by them (for example Homayoun and Bayat-e- Isfahan apparatus) are not of high importance. What is important is that whether melodic patterns through which music is created while performing are equal or variable. Organization patterns of architectural space of mosques, temples, churches and so forth have some common features. For instance, the Sassanid pentice affected in building the fire-temple in the Iranian mosques, and evolution of architectural elements have always found in the evolution and formation of new spaces. (such as converting pentice into Hasht Behesht and creation of Chahar Bagh) [6]

Le Corbusier's believes that architectural space should be felt by walking. In this sense, he believes that spaces cannot be found on a map and emphasizes the role of human in understanding space[8].

In fact, considering Heidegger's phenomenological perspective, it could be said that "space" is neither purely subjective nor purely objective but it is exactly on the border between the two. "Space" is a barrier between subject and object. Thus, if space had to be understood by humans, it should have a language appropriate to the human mind. Some of the most important properties of the space that can be understood by the human mind include proportions, scale, form, color, texture, shape, closure, light, visibility, and other elements that are functions of the characteristics of the elements defining space including, size, shape, composition , interface, edges and openings and so forth [16].

The relationship between the space of music and architecture

Two results were found in the analyses conducted on music and architecture. First, there were always a conceptual relationship between music and architecture in different eras (premodernism and postmodernism) and both of them indicated a single concept so that the two arts interrelated with each other according to the definition and requirements of the time in each era. Human being was the central core of the two arts of music and architecture and its effect in architecture is manifested in the form of a central space, which provides the best perspective with human being, and in music as musical song due to the use of human's voice. Thus, the two arts had always a close interaction with each other in all of the eras. Therefore, there was a conceptual link between music and architecture since premodernism to now, and both conveyed single concepts in each era. Secondly, it was found in premoderninsm that there was a central single concept in the time periods specified in both arts. Studies demonstrated that relationships existed in premodernism eras reflected centrality of a single concept. Studies confirmed that relationships in the pieces of premodernism have numerous layers in contrast to post-modernism, and compared them with diagrams of some popular modern pieces.

According to the approach to external shape, we can refer to the attribution of the mountain skyline and religious buildings to the peak and bass used in musical measures. One of the contemporary approaches of voice translation is to a visible form. One way to use this type of translation is the use of a method that was invented by a German physicist named "Ernest Cheladeni" in 1787. First, he spreads tiny sand on a smooth glass surface, then swings it by the violin vibrations. The vibrations produced various figures in the sand. Another way to convert music into architecture is the translation of sounds intervals to numbers. "Wassily Kandinsky" and "Paul Klee" were two artists who tried to convert music into a visible form through this method. They selected Beethoven's Symphony No. 5 for this purpose and finally found a collection of visual diagrams. Another research result in this area is the findings of a digital design project that was observed by "Chris Tensen" who designed using a parametric software including, numbers and ratios to generate 48 virtual forms based on the introductions of the first book of "Johann Sebastian Bach" and finally compared the obtained graph with arts and buildings created in that time.

Based on the approach to inner layers, popular belief holds that musical works are beautiful and pleasant when they follow certain rules; the rules that recognize their technical knowledge of physics based on sensitivity of human's ear and psyche and have measured musical instruments over thousands of years[9].

This is also true about architecture. This approach focuses on this issue. "Pythagoras" and "Plato" were the first to found hypotheses in order to demonstrate the interrelationship between mathematics, geometry, music and finally architecture and developed them in such a way that ultimately resulted in the expression of harmonious and cosmic proportions.

Another person who has done serious research on the interrelationships of music and architecture in modern times is "Ayanys Xenakis; apprentice of Le Corbusier. In the book "music and architecture, he emphasized the role of geometry sciences in conformity and studied cases of music that transformed into architecture in his work and other architects'. It is notable that he concludes at the end of his book that: "there is a virtual and mental relationship between music and architecture rather than a real one[3].

The role of music space and architecture and its approach to the child's creativity
Results showed that music (in this study, art method) was effective in enhancing children's cognitive development and added their general reasoning ability seriously (that was measured by IQ scale). With regard to the ability of verbal reasoning and short-term memory, it can be said that learning music has a significant effect on mental abilities. Spatial-temporal abilities have been significantly studied and other aspects of cognition and mental abilities have given little attention in the interaction between music and brain.

Children's music background in other countries is different from Iranian children in terms of acoustic components, and this difference results from general and minor differences of components of music (including, audio intervals, rhythm, audio color, sound, monotonic or multi-tonic, and so forth). All of these issues concerns cultural areas and musical atmosphere prevailing in Iran.

Some studies showed that there is a relationship between musical abilities and spatial-temporal reasoning. Lang and Shaw's model refers to the early sensitivity of children to music and information of variability and anatomical, physiological and chemical features of children's brain and assumes that training music strengthens and develops neural pathways involved in cognitive methods depending on environment (including, spatial abilities). According to the learning principles of the continued use of this particular neural network through music process, children's ability will be increased to do other things[10].

Mir Baha et al. (2003) demonstrated that spatial-temporal reasoning abilities of three years old children who were provided 10 to 15 keyboard private trainings for six months, twice a week and also participated in singing groups every day for 30 minutes had significantly increased compared to the three control groups (a group that were taught singing, a group who took part in computer classes and children who were not provided additional training).

Child's development psychology
Impact of environment and open spaces on children's development is of high importance from the perspective of developmental and learning psychology, and the this section findings can be exploited by architects and designers of child's space in the design process. Creation of a special atmosphere for environmental teaching and learning can accelerate the speed of the learning process and provide a more childish environment.

Jean Piaget believes that children's view of universe is different from adults' and they directly understand things through surroundings. He also believes that humans inherit two main desires; one is compatibility and the other is organization. This process is also referred to the formation of cognitive development. Compatibility means adaptation with the surrounding environment and organization refers to knowledge coordination and mental designs.

Another theory belongs to Jerome S. Bruner. His view has a fundamental emphasis on the thinking process. As Piaget's theory, Bruner's theory considers how children understand information of universe, organize it and store in their mind.

Basic requirements of child development is summarized in three points:
1. The need for recognition of environment and expansion of knowledge,
2. The need for health, physical safety and development of physical skills,
3. The need to satisfy emotions, relationship to environment and expansion of incentives.

The requirements emphasize the role of the child space and facilities available in this environment due to free and independent mobility, development of physical skills and creation of emotional bonds with it. Thus, open spaces are considered as a part of a secondary context of growth after the house, and it is necessary to provide a space for children in each circle that is proportional to the growth characteristics of that period.

In this regard, UNESCO said that play spaces can provide the children's growth needs in all areas of physical development, perceptive development, social development, and emotional development. Of course, it is clear that by such spaces, we mean the spaces that are shaped according to the psychological facts and characteristics of children and could respond their needs in the areas mentioned.[6]

Children's creativity and environment
The word creativity is used in different meaning, including productive thinking, the power of invention, imagination, intensive thinking and so forth. Moreover, several theories have been formulated on it; however, it may be said that the most comprehensive theory was developed by the American scientist, Guildford. His extensive research led to the conclusion that human intellectual abilities cannot be summarized in one dimension and be called intelligence.

Features affecting the emergence of creativity include:
1. Fluidity: production of a number of ideas at a time
2. Flexibility: production of varied and unusual ideas and different solutions for a problem
3. Novelty: the use of unique solutions
4. Development: production of details and determination of the implications and applications

5. Combination: Putting together inconsistent ideas

6. Analysis: breaking down symbolic structures into the constituent elements

7. Organization: transformation of designs, functions and uses

8. Complexity: the ability to deal with a number of different related ideas simultaneously

As other human talents, creativity is highly acquired and is not specific to particular individuals. Creativity growth needs some conditions and special education processes. There are various obstacles for exhibition of creativity that are often related to social, cultural and educational aspects except for a few of obstacles that depend on individuals" physical abilities.

Environmental perception is rooted in human's childish. The child first sees the phenomena and objects generally, and then defines them with differentiation. However, the child's relationship with environment is a local one. Instead of distances, dimensions, angles and areas, relationships such as proximity, farness, symmetry and continuity are paid attention by the child local knowledge. Therefore, the child first understand the very basic orders based on symmetry defined by continuity and proximity.

Regarding the discovery of the space, Altman and Moore state that we need to stimulate emotions and pleasure of experiencing new spaces of space discovery quality. Finding and discovering are strong motivations that cause people to enter a new space and move to find other spaces. In childhood, discovery is an important activity that foster intellectual and social growth. In addition, children's imagination power increases in environments where more discover is possible. Children highly react physically and psychologically to environmental treats. The children work in the neighborhood space and residential area if all their senses are on balance and in comfort and safety.

Children are looking for successful interaction with space to receive a sense of competence from the environment. The emergence and growth of children's creativity in space responsive to their basic needs becomes possible. Thus, design of the child's space and game space motivate flexibility and variability of elements and environmental arrangements and adaptation that reinforces the child's sense of control over space and increases his composition and decomposition ability. Of course, the children's sense of competence can be achieved without paying high prices through a set of recoverable or recycled materials.

Spaces should be provocative and fascinating for children and adolescents. A balanced level of complexity, novelty, freshness, variety and excitement is necessary in environments such as entries of residential complexes, minor roads or sidewalks and neighborhood centers. So that children adhere to the events of other environments and they do not prefer other activities that may not fit their age.

Suitability of space in children has a significant impact in the space efficiency and their environmental behavior. The greater the attention paid to the space scale to the children, the greater quality and variety of children's games in the space will be. For children, the process of interaction with space is more important than getting a result. Considering the child as the main user of the space is the best state for design. Participation of the user in the design process and surveys through methods such as painting of the neighborhood environment and their suitable interaction with the design working group, construction and intervention in the space creation can be considered [13].

Factors affecting creativity

1. Natural environmental factors: the creation of a scene in natural environment helps to develop children's creativity. Even plants in the interior space affect creativity and the creativity process.

2. The use of children's works: the works of leading artists in the decoration of the space and creation of an atmosphere that allows to show the work (children's work) day to day, can also affect the growth of children's creativity. Whatever causes the increase of children's curiosity can be effective in development of creativity. For example, colors and things that increase the variety and space using colors are effective (e.g., working with glasses that produce various colors).

If the spaces are combined in a way that their continuity is maintained between indoors and outdoors, the spaces cannot be ignored in the children's development and creativity.

Or if the space is movable based on the open plan and partitions, it is also effective in creativity.

For example, using paint colors and things that increase the versatility and space

Like working with glass that produce the various colors.

Discussion and conclusion

One of the most important issues in architecture is the space concept in recent years. Space and its meanings have been studied in other fields from various aspects besides to architecture. According to Cuaron's general definition of space, it can be said that human, space and scale are the vertices of a triangle. In fact, it can be said that space is considered as a major factor in architecture and a sense of space ownership means that the building can be seen and its understanding and recognition key can be found [15].

However, space in the music relies on mathematical rules, and harmony and order of geometry have an important role in it as the architectural space. Thus, a connection can be assumed between the two stated spaces. Music can indicate its intended melodies by complying the principles of harmony and coloring; sometimes slow, sometimes fast and powerful. The understanding of the space and hearing of different sounds and putting voices together with the rhythm and mathematical calculations can a significant factor in intellectual development and creativity in children

According to the research of the case studies, it was found that there is a relationship between music and children's cognitive and reasoning development. The results of this study are consistent with similar studies .[16]

Music and communication and early learning of music helps thinking and reasoning power and creativity. The results of the study confirmed above claim as the findings of similar studies. Ability of auditory and visual argument that is further strengthened by music in children, and Lang and Show's assumption as Terion's model, notes distances and spatial

visualization of the distances represent the effect of music on thinking, creativity and auditory and visual ability. The same effect was seen in the study. The curiosity stage is considered as one of the stages of the creativity process[21]

Natural elements of design promote creativity. For example, the color, size and shape of plants will change in different seasons, and cause spatial diversity in addition to create a new space. Moreover, the use of spectrum with colorful glasses or pond and aquarium play an important role in the diversity space. However, game and communication with these elements affect promoting children's motivation and releasing their emotions that can be considered in designs. Furthermore, architectural space where the same concepts have been considered in the form of elements such as proportions, scale and harmony, and attention to spatial influential factors, including natural factors and elements, fluidity, functional flexibility, openness and closeness, relationship between outer and inner space, diversity and stimulating space play a significant role in curiosity and affect the motivation for creativity, learning and intelligence.

Today, with the increased population of children, we should pay more attention to the children's development and growth. Space and factors affecting it can play a great role in the development of children's creativity. According to the studies, it was concluded that there is undeniably close relationship between space in music and architecture and the relationship can be used for designing children's mental and reasoning development, creativity and education

References

[1] Herbert Reed. Meaning of art. Translated by Najaf Daryabandi, p.1

[2] Herbert Reed, art and society. Translated by Soroush Habibi, pp. 14-15.

[3] Yannis Xenakis. (1987). Payam Journal.

[4] Vaziri, A.N. Aesthetics in art and nature. University Press. 1957. P.43

[5] Payam Journal, UNESCO, modern music magazine.

[6] Falamaki, M. (2008). Architecture and music.

[7] Zarghami, E. (2015). Academic- research journal (interdisciplinary studies in human sciences).

[8] Farhang, M., et al. (2007). Pp. 65-67.

[9] Sohan Gir, S., Norouz Barazjani, V. (2012). Nazar research center.

[10] Mir Baha, H., et al. (2003). Cognitive Science News. 5 (3).

[11] Noghrekar. A. (2009). Journal of Educational Innovations, 32.

[12] Delavar, A. (2008). Research Methods in Psychology and Educational Sciences. Ed. By Tehran.

[13] Hosseini, Afzal-o-Sadat. Analysis of creativity and development methods. Ph.D. Thesis, Tarbiat Modarres University, Tehran.

[14] Lang, Jhon. Creation of architecture theory. Translated by Alireza Einifar. Tehran: Tehran University Press.

[15] Memarian. A way to theoretical framework of architecture. Soroush Danesh Press.

[16] D.K. Ching. Architecture, form of space and order. Translated by Zahra Ghare Gouzlou. Tehran: Tehran University Press.

[17] Evards c p,springate k w,(1995)"Enouraging creativity in early children hood classrooms"Eric Digest,office of educational research and improvement ,washington DC.

[18]   Albert,M,Diamond   A,Fitch,R,Neville,H,Rapp,p.,&tallal,p.(1999).cognitive   development   in:M,G   Zigmund   F.E.B   loom   &S.C. Landis(Eds).Fondamental neruso.

 [19]   Choi,B.,&Pak.A.(2006).Multidisciplinarity   ,interdisciplinarity   and   transdisdisciplinaity   in   health   research   ,services,education   and policy:1.Definitions,objectives,and evidenceof effectiveness.Clinical and investigative medicine.Medecine clinine et experimentale,29(6),351-364.

[20] De Certeau ,M.(1984)The practice of everyday life .University of California Press:Berkeley   .

[21] Bilhartz ,T.D ,Bruhn, R.A &Olsun J.E.(2000).The effect of early music training of child cognitive development .Journal of applied in Developmental phisycology.

An Approach for Material Selection Problem in Architectural Design

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Abstract—One of the major issues faced in architectural design or a designer is to determine the most convenient material, which fits his/her, design. This is an important decision making problem. Because in case of making a wrong decision, it can be faced with choosing the wrong material which does not meet requirements of design. In addition, wrong decisions causes high cost. Especially, if there are many materials to be selected, using a systematic method, which describes how decision should be made, will be very useful. In design problems, it is thought to sufficient that, the material to be chosen should fit nature of design, and structure, in generally. However, each material has different attributes and it should be used in design by considering these attributes. For instance, in designing of a concert hall, it is required that floor covering material has incombustibility. On the other hand, in designing of a hospital, hygiene attribute becomes prominent for floor covering material. Additionally, it is required extra attributes such as anti-slip, ease of use, cost and so on. If a material completely meets all of the required attributes, then there is no decision problem. However, most of time, a material is good in some attributes while poor in the others. Moreover, there are a lot of materials that can be used. In this case, decision maker (most of time architect) faces such a decision making problem. This kind of problem, choosing a good one among the alternatives, is called multi criteria decision making problem (MCDM). MCDM techniques try to determine convenient alternative, which fits ideally to criteria defined by decision maker. There are different techniques such as Topsis, Analytical hierarchy process (AHP), Electre, Promethee, and Vikor. Topsis becomes prominent in terms of its easiness and clearness among these techniques. In this study, it is proposed an approach about selection of material in architectural design by using Topsis method. The reminder of the study is structured as follows. After introduction section, Topsis method is described, briefly, in section 2. In section 3, the steps of Topsis method on selection of floor covering material for an architectural design is explained. In section 4, the results are concluded.

Keywords—TOPSIS method, material selection, floor material selection, interior design

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Feasibility of Ground Alkali-Active Sandstone Powder for Use in Concrete as Mineral Admixture

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Abstract—Alkali-active sandstone aggregate was ground by vertical and ball mill into particles with residue over 45 μm less than 12%, and investigations have been launched on particles distribution and characterization of ground sandstone powder, fluidity, heat of hydration, strength as well as hydration products morphology of pastes with incorporation of ground sandstone powder. Results indicated that ground alkali-active sandstone powder with residue over 45 μm less than 8% was easily obtainable, and specific surface area was more sensitive to characterize its fineness with extension of grinding length. Incorporation of sandstone powder resulted in higher water demand and lower strength, advanced hydration of C_3A and C_2S within 3days and refined pore structure. Based on its manufacturing, characteristics and influence on properties of pastes, it was concluded that sandstone powder was a good selection for use in concrete as mineral admixture.

Keywords—Concrete, mineral admixture, hydration, structure.

I. INTRODUCTION

GREAT awareness has been raised on alkali-aggregate reaction (hereafter as AAR), one of the most concerned problems hydropower station construction went great lengths to avoid [1]-[3], and preventive measures should be taken such as excavating harmful aggregates, limiting maximum alkali content in cement and concrete, adding pozzolanic materials to replace cement as well as using some inhibitor [4]-[7]. So far, hydropower stations failure caused by AAR was seldom reported in Mainland China [8], thanks to popularization of use of mineral admixture in concrete including fly ash, blast furnace slag, silica fume as well as some other pozzolanic materials [9]-[11]. Danjiangkou hydropower station, the water source of South-to-North Water Diversion project, used blast furnace slag as mineral admixture because flint was detected in aggregates. Both Xiaolangdi and Jinping I hydropower stations [7] used fly ash and low-alkali cement to batch concrete to ensure safety. So far, use of non-alkali active aggregates was the safest and most reliable measure with respect of AAR prevention, yet the selection of aggregates was subjected to many constraints considering continuous consumption of natural resources and restriction of budgets. A great challenge was approaching that active aggregates, especially silica active aggregates, were widely distributed and good quality aggregate resource was no more bottomless and inexhaustible, and when no choice was left but to use alkali active aggregates, remedial measures should be taken to ensure durability and safety of engineering structures.

So far, only seldom hydraulic engineering was reported to have used alkali active aggregates in Mainland China, in which Jinping I hydropower station construction had used marble sand and sandstone coarse aggregate to batch concrete and sandstone coarse aggregate was detected as alkali active and as aforementioned, good quality fly ash and low alkali cement were used and strict control on total amount of alkali content in concrete was implemented to ensure the safety of engineering structure. Nevertheless, so far no information on use of ground alkali-active aggregate powder in concrete as mineral admixture was reported.

This present paper had developed a new material for use in concrete as mineral admixture based on sandstone aggregate which was detected as alkali-active by accelerated mortar bar testing and supposed to be applied on a mega hydropower station construction located in southwest of China. Manufacturing and characterization of sandstone powder, fluidity, thermal and mechanical, deformation as well as durability of concrete batched with this sandstone powder were also investigated.

II. EXPERIMENTAL

A. Materials

Moderate heated cement (M.H.cement) with 28d compressive strength no less than 42.5 MPa was used for tests, and fly ash of good quality was also introduced for comparison tests. The chemical components of these two materials were listed in Table I and quality parameters of fly ash listed in Table II.

TABLE I
CHEMICAL COMPONENT OF CEMENT AND FLY ASH FOR TESTS

Type	CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	SO_3	R_2O^*	Loss
M. H. Cement	59.3	22.8	3.1	4.8	4.7	2.2	0.3	1.4
Fly ash	1.8	53.0	22.9	10.2	3.3	1.0	1.5	5.6
Sandstone	2.2	64.2	14.5	5.7	4.5	0.2	3.1	3.0

Note: $Na_2O_{eq.}$ is the equivalent content of Na_2O and is calculated by $Na_2O+0.658K_2O$.

Sandstone aggregates excavated from a hydropower station construction site located in southwest of China were shifted to laboratory for tests and the aggregates were ground to powder with different fineness. The chemical components of sandstone were listed in Table I. Alkali reactivity of sandstone aggregate was detected according to ASTM C1260 and test results demonstrated in Table III, as seen, sandstone aggregate was potentially alkali active with 14d expansion exceeding 0.1% and 28d expansion reached 0.359%.

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TABLE II
QUALITY PARAMETERS OF FLY ASH

Parameter	Residue over 45μm sieve (%)	Specific surface area (m²/kg)	Water requirement ratio (%)	Apparent density (kg/m³)	28d compressive strength ratio* (%)
Fly ash	6.6	357	101	2500	67

Note: referring to compressive strength ratio of 30%fly ash-cement mortar and controlled cement mortar

TABLE III
ALKALI REACTIVITY DETECTION OF SANDSTONE

Aggregate	Mortar bar expansion (%)				
	3d	7d	14d	21d	28d
Sandstone aggregate	0.063	0.161	0.229	0.317	0.359

Mineral determination of sandstone aggregate was launched by polarizing microscope as displayed in Fig. 1 and it was identified as the composites of siltstone rock and substrates in approximate proportion of 75:25 by mass, in which the siltstone was constituted of quartz, feldspar and biotite while substrate was composed of black organic matrix, small amount of cryptocrystalline and stripped sericite.
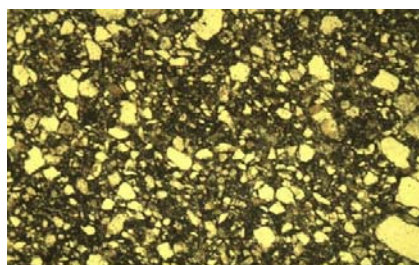
Fig. 1 Mineral determination of sandstone aggregate

B. Sampling and Test Methods

To perform fluidity and strength tests, mix proportion of mortar was prepared as cementitious materials and water ratio at 2:1 and cementitious materials and sand ratio at 3:1, and the replacement levels of supplementary materials was 15%, 25%, 35%, 45%, and 55% respectively by mass of cement, and the sandstone powder used for paste and mortar test had specific surface area of 645 m²/kg. Superplasticizer was not used in mortar.

Heat of hydration was performed according to ASTM C186-2015 and heat releasing of composite pastes was detected by micro calorimeter C80. For heat releasing detection, 500 mg uniformly-mixed cementitious materials was prepared as sample and analytical reagent SiO_2 was used for reference, and testing temperature was controlled at 28 ℃.

Samples for compressive tests were batched with water/binder ratio of 1:2 and sand/binder ratio of 3:1.

The morphology of hydration products was observed by field scanning emission microscopy (FSEM). A comprehensive analysis of cement-ground sandstone powder paste by mercury intrusion porosimetry (MIP) technique was also performed. The low pressure of mercury intrusion ranges from 0.007 MPa to 0.207 MPa, and the high-pressure ranges from 0.207 MPa to 379.225 MPa. The measured pore sizes range from 0.003 μm to 175 μm.

III. RESULTS AND DISCUSSION

A. Manufacture of Sandstone Powder

Alkali-active sandstone aggregate was crushed by Barmac crusher into particles sized less than 10 mm which was subsequently put into vertical mill RM2200 for finer grounding. Sandstone powder particles with residue over 45 μm less than 8% was obtained by adjusting mill parameters, including segregator speeder at 40 Hz, roller pressure at 6.9 MPa, input and output temperature at 180 ℃ and 72 ℃ respectively, and the feed amount at 21t/h. The final outcome of finished powder had residue over 45 μm and 75μm at 5.8% and 0.2% respectively as displayed in Table IV, better than the set target. The morphology of ground sandstone powder was illustrated in Fig. 2.

B. Particles' Distribution and Characterization

Sandstone powder was further processed by ball mill to obtain different fineness samples. The fineness was characterized both by residue over 45 μm sieve and specific surface area, and the relationship in between was illustrated in Fig. 3. As seen, good conformity was observed between these two parameters which varied in the manner as specific surface area exhibited rising tendency as grinding length extended while residue over 45μm sieve showed decreasing trend, and when grinding length exceeded 40 minutes, specific surface area was more sensitive to characterize the fineness.

Laser particle size analyser (LPSA) produced by Beckman Coulter was employed to determine the particle size and distribution of sandstone powder as displayed in Fig. 4. Obviously, particles sized less than 80 μm accounted for over 90% by volume, in which smaller particles sized less than 16 μm ranged between 50.6% and 86.7%. As the majority of cement particles sized between 10 μm and 60 μm [12], and very large number of particles in sandstone powder sized less than 5 μm was present, and the latter could produce good filling effect among cement particles and condense the structure.
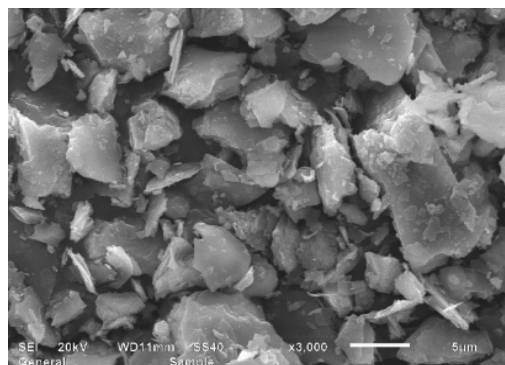

Fig. 2 Morphology of ground sandstone powder

TABLE IV
THE REAL-TIME PRODUCTION AND CHECK OF SANDSTONE POWDER

Samples	Feed amount (ton)	Segregator speed (Hz)	Mill pressure (MPa)	Input temperature (°C)	Output temperature (°C)	Fineness (%)	
						residue over 45μm	residue over 75μm
1	30	40	7.20	184	76	4.7	0.1
2	32	36	6.82	188	73	6.0	0.2
3	32	36	7.70	191	75	6.2	0.1
4	32	36	6.94	189	76	5.8	0.2
5	32	36	6.79	182	77	6.5	0.2
Average	32	36	7.00	185	70	5.8	0.2
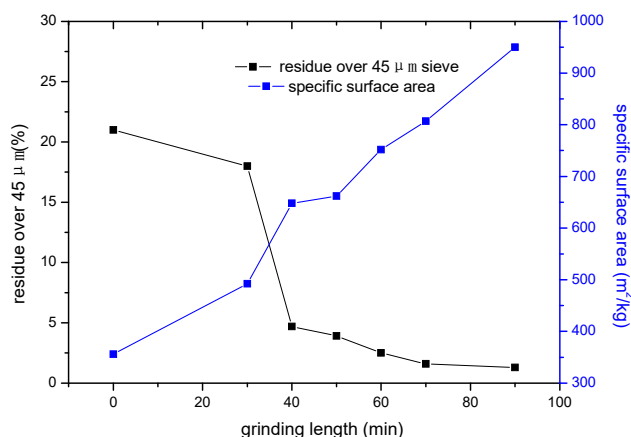
Fig. 3 Specific surface area vs. residue over 45 μm sieve
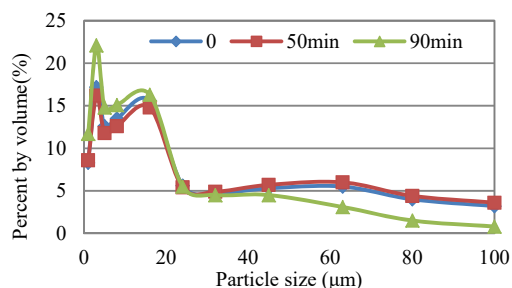
(a) Particles size and distribution
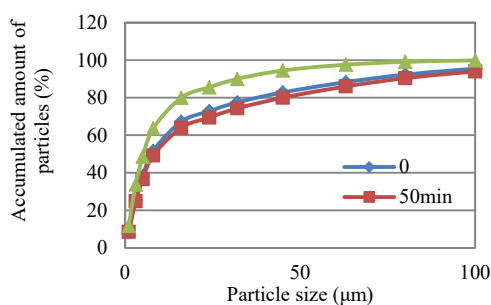
(b) Accumulative percent

Fig. 4 Particles characteristics of sandstone powder of different fineness

C. Fluidity of Composite Pastes

Sandstone powder was incorporated in paste replacing cement in different proportions ranging from 15% to 55% and its influence on fluidity of pastes was illustrated in Fig. 5, also comparison with fly ash was conducted. Obviously, sandstone powder had adverse effect on fluidity of pastes, which varied in the manner as fluidity decreased with increment in sandstone powder content ranging between 15% and 55%, while the trend was reversed with respect to fly ash paste. The results implied that sandstone powder in use of concrete as mine admixture would result in higher unit water demand and in order to maintain the same fluidity larger amount of water reducer was required in case of the same mix proportion.
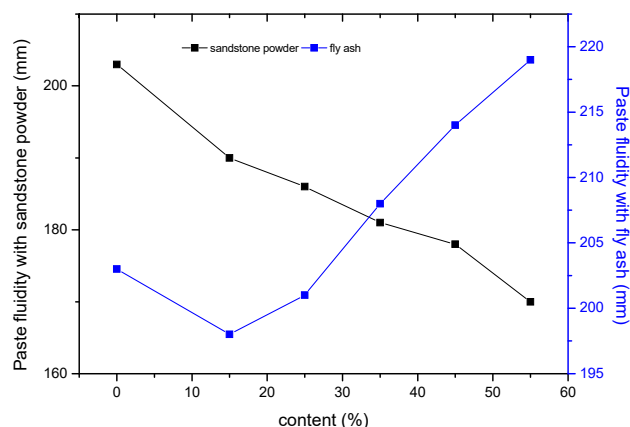
Fig. 5 Fluidity of composite pastes with incorporation of sandstone powder and fly ash

D. Heat of Hydration

The heat of hydration of composite pastes with incorporation of sandstone powder and fly ash respectively was tested according to ASTM C186-2015, and results were illustrated in Fig. 6, and heat releasing of composite pastes was also detected with introduction of micro calorimeter as demonstrated in Figs. 7 and 8, in which the characterized values of heat flow of hydration released by composite paste were listed in Table 5.

As clearly seen, the heat of hydration of composite pasts was lower than the control mixture despite of different replacements and the reduction magnitude grew more obvious as increase in content of supplementary materials. In case of the same supplementary content, ground sandstone powder-cement pastes produced a little higher heat of hydration than fly ash-cement pastes within 7d testing age, which was interpreted as micro particles with greater specific surface area in ground sandstone powder had accelerated hydration of cement clinker [14] and part of sandstone powder participated in hydration.

The hydration process of composite pastes was also grouped into five stages according to Figs. 7 and 8 and incorporation of sandstone powder reduced total heat of hydration within 72h by 15% which was exactly the content of sandstone powder replacing cement by mass, in good conformity with aforementioned strength decreasing magnitude.

By comparison of heat flow peaks in Table 5, sandstone powder had advanced hydration of C3A from 276.8 s to 224.9 s and decreased heat flow only by 5%, lower than its replacement of 15%. Accordingly, heat flow peak produced by hydration of C2S and C3S was advanced from 9.45h to 8.91h and its heat flow peak reduced by 9%, also lower than the replacement of sandstone powder. The results implied that sandstone powder had accelerated larger amount of cement clinker participating in hydration within 3d and some of sandstone powder also had hydrated under alkali environment and made its contribution to heat of hydration.

E. Compressive Strength of Composite Pastes

Fig. 9 presents the compressive strength of composite pastes with sandstone powder (specific surface area of 645 m^2/kg) and fly ash incorporated respectively. The compressive strength of all composite pastes was lower than the control mixture in spite of ages and replacement ratio, whereas significant increase in compressive strength of composite paste with sandstone powder was observed when testing age was extended from 3d to 28d, while it was slowed down from 28d to 90d. Obviously, fly ash pastes produced greater compressive strength increase than sandstone powder pastes with testing age extending when replacement by mass of cement was less than 45%, which justified higher pozzolanic reactivity of fly ash and greater contribution to strength gain produced by reacting with Ca(OH)$_2$ released from hydration of cement [13].

TABLE V
CHARACTERIZED VALUES OF HEAT FLOW OF HYDRATION RELEASED BY CEMENT-BASED MATERIALS

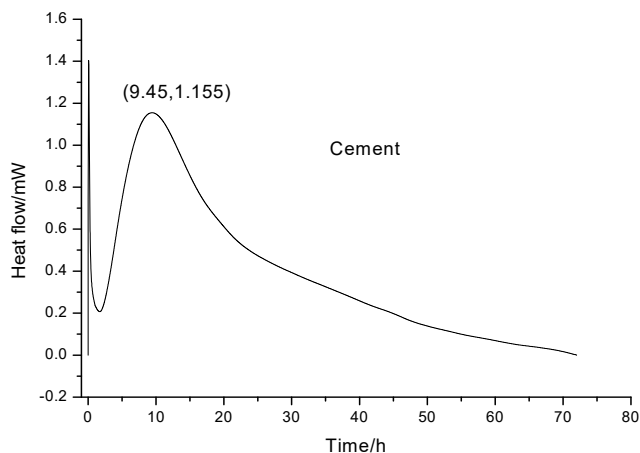| Cementitious System	Total heat of hydration	Heat flow peak at pre-induction stage		Heat flow peak at accelerating stage	
	kJ/kg	Occuring time/s	Heat flow/mW	Occuring time/h	Heat flow/mW
Cement	198.0/100%	276.8	1.402/100%	9.45	1.155/100%
15%sandstone powder-cement	168.4/85%	224.9	1.331/95%	8.91	1.056/91%
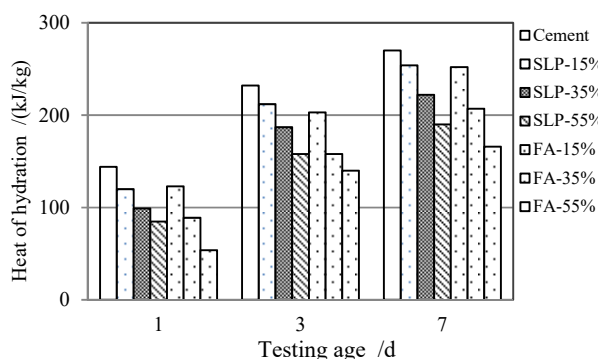
Fig. 6 Heat of hydration of composite pastes
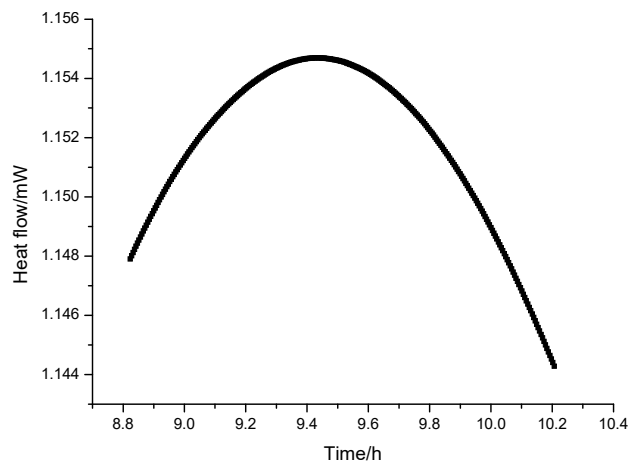
(b) II heat peak

Fig. 7 Heat releasing of cement paste

F. Pore Structure of Composite Pastes

Pore structure of composite pastes was illustrated in Table 6 and Fig. 10. Porosity of composite pastes exhibited decreasing tendency with development of curing time while showed a rising trend with increase in replacement of sandstone by mass of cement. Besides, when the replacement of sandstone powder increased from 25% to 35%, the per cent of pores sized less than 100 nm which was believed to have positive effect on various performances of pastes had also decreased from 66.22% to 57.71% at 28d.
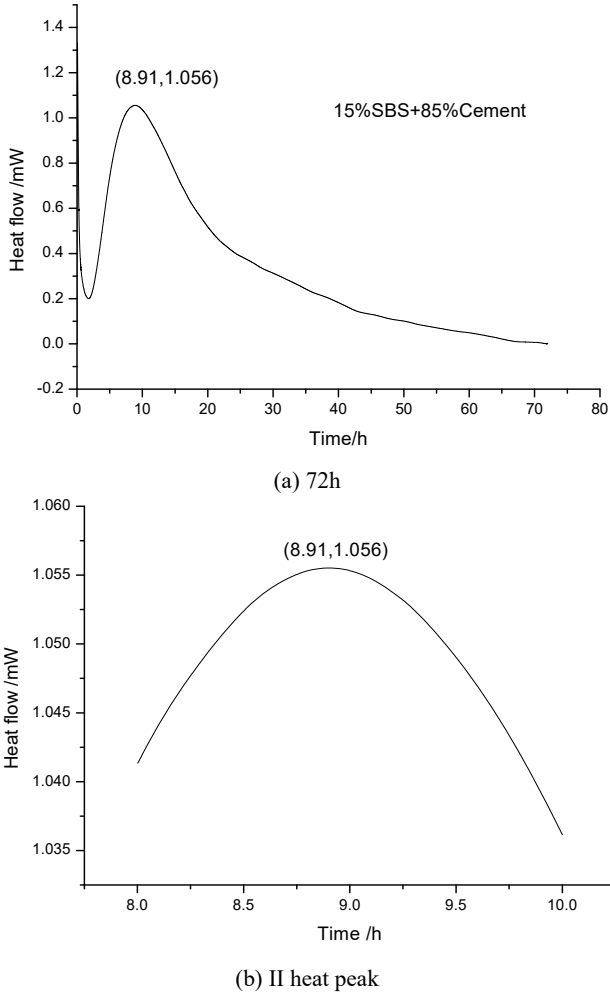

(a) 72h

(a) 72h

(b) II heat peak

Fig. 8 Heat releasing of 15% sandstone powder-cement paste

At replacement of 35%, the porosity of sandstone powder composite paste decreased from 23.01% at 3d to 19.63% at 28d, and the percent of pores sized less than 100 nm had correspondingly increased from 26.14% to 57.71%. By comparison, combination of fly ash and sandstone powder with replacement of 25% in total had no obvious effect on early pore structures, in good conformity with aforementioned strength development from 7d to 28d, yet good improvement was observed from 7d to 180d with porosity decreasing from 19.20% to 13.04% and percent of pores less than 50 nm increasing from 28.96% to 48.08% dramatically.
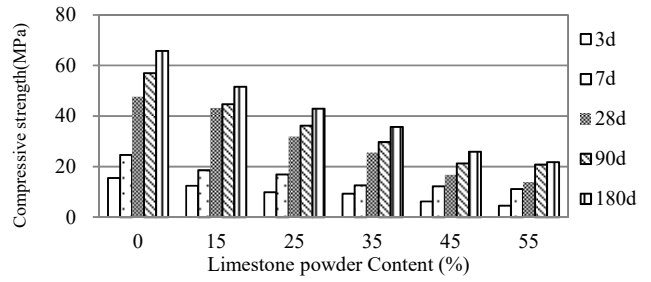
(a) Replacement of 0~55% of cementitious materials by sandstone powder
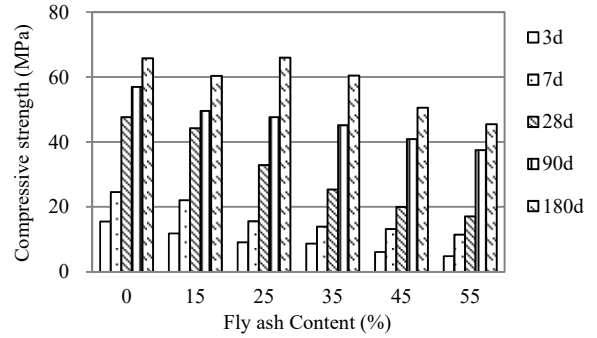
(b) Replacement of 0~55% of cementitious materials by fly ash
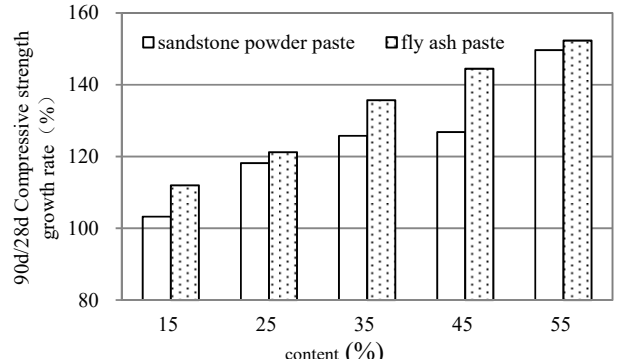

(c) 90d/28d ratio

Fig. 9 Compressive strength of composite pastes

TABLE VI
POROSITY AND PORES DISTRIBUTION OF PASTES

| No.	SCM	Age (d)	Porosity (%)	Pore distribution (nm)			
				<5	5~50	50~100	100~200
SBS-25%	25%sandstone powder	7	19.20	4.56	24.61	11.17	59.66
		28	17.83	7.82	36.92	21.48	33.78
SBS-35%	35% sandstone powder	3	23.01	1.95	16.68	7.51	73.86
		7	21.70	2.64	20.51	8.65	68.20
		28	19.63	5.71	32.78	19.22	42.29
SBF	15%SBS+10%FA	3	21.17	2.24	17.12	8.38	72.26
		7	19.20	4.32	24.64	10.99	60.05
		180	13.04	8.31	39.77	9.32	42.60
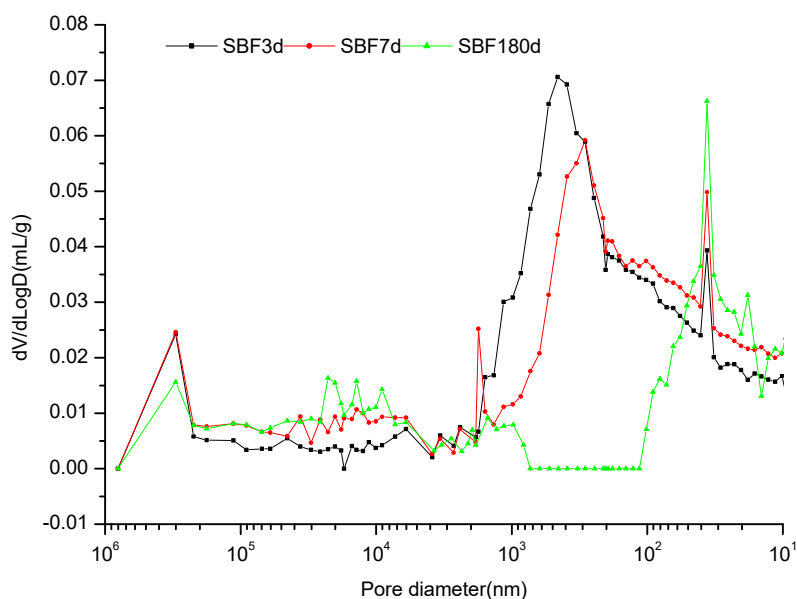
(a) Sandstone powder and fly ash
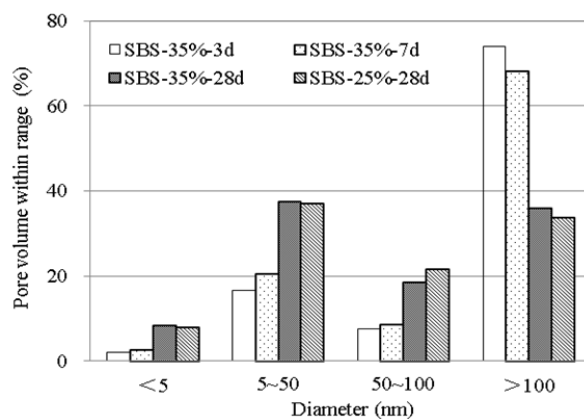
(b) Sandstone powder

Fig. 10 Porosity and pores distribution of composite pastes

G. Hydration Products Morphology

Fig. 11 presented the morphology of products of hydration of composite pastes at different ages, and the products of hydration were primarily consisted of lathy and fibre C-S-H, flaked and granules crystalline, which grew outside from the surface of un-hydrated particles, and many products of hydration was discernible from the pastes and no big difference was observed in the total amount of products of hydration between composite pastes adding fly ash and sandstone powder respectively at the same age. At 28d, the produced C-S-H gel of fly ash pastes sized between 5 μm and 10 μm and part of products of hydration covered on the surface of fly ash particles, and the structure grew more tense with age despite of visible voids. As for the sandstone powder-fly ash-cement ternary composite, large amount of products of hydration was also distinguished from Fig. 10 and C-S-H gel 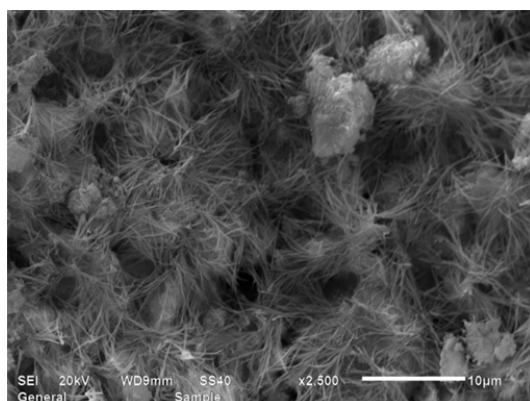had length of approximately 5 μm~10 μm, and by 180d the ternary composite structure grew condense and fly ash particle was fiercely beset by products of hydration.
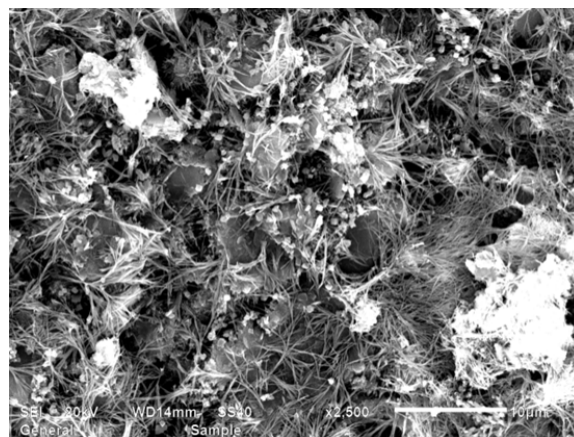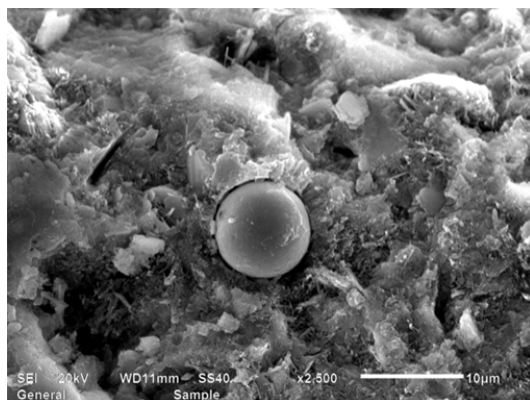

(a) 25% sandstone powder-28d
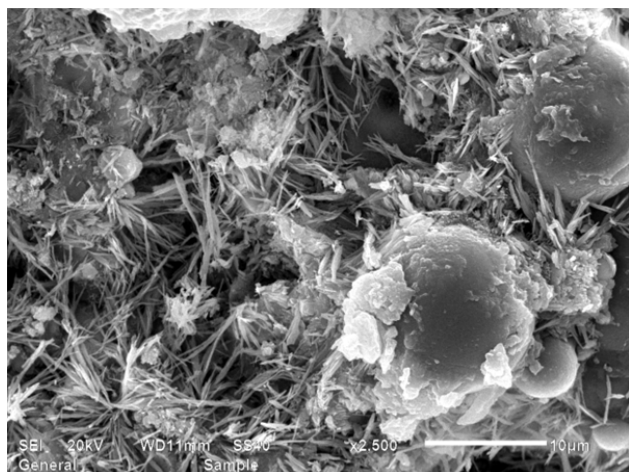
(b) 25% fly ash-28d

(c) 15% sandstone powder+10%fly ash-3d

(d) 15% sandstone powder+10%fly ash-180d

Fig. 11 SEM patterns of composite pastes

IV. CONCLUSIONS

Hydration characteristics and microstructure of composite system was reached that ground alkali-active sandstone powder was feasible for use in concrete as mineral admixture. Ground alkali-active sandstone powder with residue over 45 μm less than 8% was easily obtainable by vertical and ball mill, and incorporation of sandstone powder would increase unit water demand and decrease early strength of composite

pastes, yet it also advanced hydration of C_3A and C_2S within 3days and refined pore structure.

REFERENCES

[1] Tang M S. Review on AAR development over the world. China Concrete and Cement Products, 1993, 1:4-6.

[2] Shi, C, Shi, Z, Hu, X, et al. A review on alkali-aggregate reactions in alkali-activated mortars/concretes made with alkali-reactive aggregates. Materials and Structure, 2015, 48(3): 621-628.

[3] Costa, F L, Torres, A S& Neves, R.A. J. Analysis of concrete structures deteriorated by alkali-aggregate reaction: case study. Journal of Building Pathology and Rehabilitation, 2016, 1: 13.

[4] Mohamed, I, Curtil, L, Ronel-Idrissi, S. et al. Influence of composite materials confinement on alkali aggregate expansion. Materials and Structure, 2005, 38(3): 387-394.

[5] Mo, I. X. Y., Xu, Z. Z., Wu, K. R. et al. Effectiveness of LiOH in inhibiting alkali-aggregate reaction and its mechanism(J). Materials and Structure, 2005, 38(1): 57-61.

[6] Li P X, Wang L, Peng S S. Experimental study on measures for inhibiting alkali - aggregate reaction of quartz sandstone. Yangtze River, 2013,7:75-78.

[7] Li G W, Zhou Q W. Engineering measures for inhibiting concrete alkali-aggregate response during construction of high arch dam of Jinping I Hydropower Station. Water Resources and Hydropower Engineering, 2013, 1:45-49.

[8] Li J Y. Alkali-aggregat reaction in dam concrete of China.Water Power, 2005, 1:34-37.

[9] Yang H Q, Li P X, Chen X. The State-of-art of Alkali Aggregate Reaction of Hydraulic Concrete. Journal of Yangtze River Scientific Research Institute, 2014, 10:58-62.

[10] Yang H Q, Li P X. Experimental study on alkali-reactive granitic aggregates of Three Gorges project. Journal of Hydroelectric Engineering, 2010, 2:222-227.

[11] Dong Y, Yang H Q, Li P X. Research on inhibition of alkali aggregate reactivity with natural pozzolans. Concrete, 2011, 11:77-79.

[12] Zhu B L, Huang X, Guo Ye, e tal. Packing Density of Cement in Paste with Continuous Grain Size Distribution. Journal of Building Materials, 2006, 4:447-452.

[13] Wang C, Yang C H, Qian J S, e tal. Behavior and Mechanism of Pozzolanic Reaction Heat of Fly Ash and Ground Granulated Blastfurnace Slag at Early Age. Journal of The Chinese Ceramic Society, 2012, 7:1050-1058.

[14] Song J W, Wang L, Liu S H, et al. Functionary Mechanism of Limestone Powder in Ultra High Performance Cement-Based Materials. Bulletin of the Chinese Ceramic Society, 2016, 4:4104-4109.

Deformation Mechanisms of Mg-Based Composite Studied by Neutron Diffraction and Acoustic Emission

G. Farkas, K. Máthis, J. Pilch, P. Minárik

Abstract—Deformation mechanisms in a Mg-Al-Ca alloy reinforced with short alumina fibres were studied by acoustic emission and in-situ neutron diffraction method. The fibres plane orientation with respect to the loading axis was found to be a key parameter, which influences the acting deformation processes, such as twinning or dislocation slip. In-situ neutron diffraction tests were measured at different temperatures from room temperature (RT) to 200°C. The measurement shows the lattice strain changes in the matrix and also in the reinforcement phase depending on macroscopic compressive deformation and stress. In case of parallel fibre plane orientation the increment of compressive lattice strain is lower in the matrix and higher in the fibres in comparison to perpendicular fibre orientation. Furthermore, acoustic emission results indicate a larger twinning activity and more frequent fibre cracking in sample with perpendicular fibre plane orientation. Both type of mechanisms are more dominant at elevated temperatures.

Keywords—Neutron diffraction, acoustic emission, magnesium based composite, deformation mechanisms.

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Effect of Pistachio Shell Reinforcement on Adhesive Wear Behaviour of Polypropylene Matrix Composites

Alp E. Sahin, Beysim Cetin, Tamer Sinmazcelik

Abstract—Polypropylene (PP) is a well-known thermoplastic material that has a large usage area in the automotive industry, mechanical engineering, packaging industry and electronics due to its cheapness and reasonable mechanical properties. On the other hand, poor thermal barrier performance and low modulus are the disadvantages of this material. PP cannot be used as raw material to produce optical and esthetic appeal parts because of its easy to scratch structure. To eliminate these disadvantages of PP, it is reinforced by particle and/or fibre materials in general. Pistachio shell is a natural material which has cheap economical or industrial value. It is mostly burned and used as heat source in winter or has some limited industrial usage. In this study, polypropylene matrix material reinforced with ground pistachio shell particles, sized between 20 µm and 100 µm at various weight ratios (1, 3, 5, 10 %wt). Pistachio shell reinforced PP samples were melt mixed using laboratory scale twinscrew extruder and samples were produced by injection molding method. Ball on disc test method was used to determine the effects of pistachio shell reinforcement on adhesive wear behaviour of PP. Tests were performed under normal load of 20 N and 0,13 m/s rotating speed along 150 m sliding distance. Pistachio shell reinforced PP composites showed better resistance than pure PP against wear according to test results. As a result, pistachio shell is economically and ecologically proper to us as reinforcement material to PP.

Keywords—adhesive wear, pistachio shell, polypropylene, thermoplastic composite

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A New Backstepping Controller for a Variable Wind Speed Energy Conversion System Based on a Dfig

Tamou Nasser, Ahmed Essadki, Sara Mensou

Abstract—— In this paper we present a contribution for the modeling and control of wind energy conversion system based on a doubly Fed Induction Generator (DFIG). Since the wind speed is random the system has to produce an optimal electrical power to the Network and ensures important strength and stability. In this work, the Backstepping controller is used to control the generator via two converter witch placed a DC bus capacitor and connected to the grid by a Filter R-L, in order to optimize capture wind energy. All is simulated and presented under Matlab/Simulink Software to show performance and robustness of the proposed controller.

Keywords—Wind Turbine, Doubly Fed Induction Generator, MPPT Control, Backstepping Controller, Power Converter

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Laser Welding Technique Effect for PEM Fuel Cell Application

Chih-Chia Lin, Ching-Ying Huang, Cheng-Hong Liu, Wen-Lin Wang

Abstract—A complete fuel cell stack comprises several single cells with end plates, bipolar plates, gaskets and membrane electrode assembly (MEA) components. Electrons generated from cells are conducted through bipolar plates. The amount of cells components increases as the stack voltage increases, complicating the fuel cell assembly process and mass production.Stack assembly error influenced cell performance. PEM fuel cell stack importing laser welding technique could eliminate transverse deformation between bipolar plates to promote stress uniformity of cell components as bipolar plates and MEA. Simultaneously, bipolar plates were melted together using laser welding to decrease interface resistance. A series of experiments as through-plan and in-plan resistance measurement test were conducted to observe the laser welding effect. The result showed that the through-plan resistance with laser welding was drop of 97.5-97.6% when the contact pressure was about 1MPa to 3 MPa, and the in-plan resistance was no significantly different for laser welding.

Keywords—PEM fuel cell, Laser welding, Through-plan, In-plan, Resistance.

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Field Synergy Analysis of Combustion Characteristics in the Afterburner of SOFC System

S.-C. Chang, C.-H. Yang, W.-S. Chang, C.-C. Lin, C.-H. Li

Abstract—The solid oxide fuel cell (SOFC) is a promising green technology which can achieve a high electrical efficiency. Due to the high operating temperature of SOFC stack, the off-gases at high temperature from anode and cathode outlets are introduced into an afterburner to convert the chemical energy into thermal energy by combustion. The heat is recovered to preheat the fresh air and fuel gases before they pass through the stack during the SOFC power generation system operation. For an afterburner of SOFC system, the temperature control with a good thermal uniformity is important. A burner with a well-designed geometry usually can achieve a satisfactory performance. To design an afterburner for a SOFC system, the computational fluid dynamics (CFD) simulation is adoptable. In this paper, the hydrogen combustion characteristics in an afterburner with simple geometry are studied by using CFD. The burner is constructed by cylinder chamber with the configuration of a fuel gas inlet, an air inlet and an exhaust outlet. The flow field and temperature distributions inside the afterburner under different fuel and air flow rates are analyzed.

To improve the temperature uniformity of the afterburner during the SOFC system operation, the flow paths of anode/cathode off gases are varied by changing the positions of fuels and air inlet channel to improve the heat and flow field synergy in the burner furnace. Because the air flow rate is much larger than the fuel gas, the flow structure and heat transfer in the afterburner is dominated by the air flow path. The present work studied the effects of fluid flow structures on the combustion characteristics of a SOFC afterburner by three simulation models with a cylindrical combustion chamber and a tapered outlet. All walls in the afterburner are assumed to be no-slip and adiabatic. In each case, two set of parameters are simulated to study the transport phenomena of hydrogen combustion. The equivalence ratios are in the range of 0.08 to 0.1.

Finally, the pattern factor for the simulation cases are calculated to investigate the effect of gas inlet locations on the temperature uniformity of the SOFC afterburner. The results show that the temperature uniformity of the exhaust gas can be improved by simple adjusting the position of gas inlet. The field synergy analysis indicates the design of the fluid flow paths should be in the way that can significantly contribute to the heat transfer, i.e. the field synergy angle should be as small as possible. In the study cases, the averaged synergy angle of the burner is about $85°$, $84°$, and $81°$ respectively.

Keywords—Afterburner, combustion, field synergy, solid oxide fuel cell.

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Physical and Electronic Records Management: The Need for Combine Approach for Effective Management of Polytechnics in North Western Nigeria

Kabir Haro

Abstract—This paper assessed the extent of the implementation of the combined approach of Physical and Electronic Records Management for effective management of Polytechnics in North Western Nigeria, to ensure adequate protection of their records in the event of any kind of disaster and comply with the Data Protection Act. The institutions focus exclusively on Physical or Paper Based Records Management through filing. Cupboards, wooden shelves/cabinets, steel shelves, drawers for flat files, box file and top of tables are the storage facilities made available. Compliance with the International standard, adequate storage facilities under good environment is computerization of all records that is the implementation of Electronic Records Management through Computer Storage devices/store data source, CD/DVD, Floppy disk, Flash drive, Memory card, RAM, Hard disk, external hard disk or data bank etc. The purpose of this study is to determine the extent of implementation of the Electronic Records Management System in the institutions which extremely contributes to preservation records. A descriptive survey design was adopted in carrying out the study. A questionnaire was used in the collection of data. The results of the study, among others, showed that the management of the institutions partially implemented the Electronic Records Management in handling their administrative records, staff records, financial records, medical records, student's records, examination records, etc. while majority of the academic staff, non-academic, and students generally feel that the combine approach of the Physical and Electronic Records Management is more secured and reliable, periodic check to ensure proper management are all identified as strategies that will enhance the effective management of records. The following recommendation were made based on the following findings of this study; effective Electronic Records Management should be adopted and combine it with the Physical or Paper Base Records Management for effective records management in the Institutions as well as adequate training and retraining of records managers such as Secretaries, Administrative Officers, Clerks, and Examination Officer etc.

Keywords—electronic, management, physical, records

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Numerical Investigation and Optimization of the Effect of Number of Blade and Blade Type on the Suction Pressure and Outlet Mass Flow Rate of a Centrifugal Fan

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Abstract—Number of blade and blade type of centrifugal fans are the most decisive factor on the field of applicaiton, noise level, suction pressure and outlet mass flow rate. Nowadays, in order to determine these effects on centrifugal fans, numerical studies are carried out in addition to experimental studies. In this study, it is aimed to numerically investigate the changes of suction pressure and outlet mass flow rate values of a centrifugal fan according to the number of blade and blade type. Centrifugal fans of the same size with forward, backward and straight blade type were analyzed by using a simulation program and compared with each other. This analysis was carried out under steady state condition by selecting k-Ɛ turbulence model and air is assumed incompressible. Then, 16, 32 and 48 blade centrifugal fans were again analyzed by using same simulation program, and the optimum number of blades was determined for the suction pressure and the outlet mass flow rate. According to the results of the analysis', it was obtained that the suction pressure in the 32 blade fan was twice the value obtained in the 16 blade fan. In addition the outlet mass flow rate increased by 45% with the increase in the number of blade from 16 to 32. There is no significant change observed on the suction pressure and outlet mass flow rate when the number of blades increased from 32 to 48. In the light of the analysis results, the optimum blade number was determined as 32.

Keywords—Blade type, centrifugal fan, computational fluid dynamics, outlet mass flow rate, suction pressure.

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